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THE DAY OF THE TUNGSTEN-FILAMENT LAMP.

At the meeting last week of the New York section of the Illuminating Engineering Society, Dr. Clayton H. Sharp delivered a very interesting address upon "New Types of Electric Lamps." The improvement of the metallized-filament lamp over the older type of carbon-filament lamp was commented upon, and an exhibition made of the various forms of incandescent lamps with which the market is familiar at the present time. While attention was given to the work of von Welsbach, Kusel and others in connection with the metal-filament lamps, the greatest emphasis was laid upon the development of the tungsten-filament lamp. This lamp has become a commercial possibility much sooner than was expected, and notwithstanding the fineness and fragility of the filament, the lamp is being shipped long distances and used with great success. The high intrinsic brilliancy is apparently not a matter of commercial significance, because contemporaneously with the development of this filament have come about the design and manufacture of reflectors admirably suited to soften and diffuse the large volume of light produced. Among the other essential advantages of the tungsten lamp, apart from its efficiency of 1.25 watts per candle, rendering it a very cheap form of illuminant, its color quality is peculiarly adaptable to more delightful creations in indoor decoration. The hostess now can properly illuminate the table decorations, can have the walls covered with the softest and most pleasing tints, and can utilize floral decorations which heretofore have not been acceptable.

One of the most significant statements elicited during the discussion was that the twenty-five-watt tantalum lamp was a commercial possibility and that if it were not developed and placed upon the market it would be because there was not a demand for it. With regard to the tungsten lamp in the lower candle-powers, it was definitely stated that a twenty-watt tungsten lamp had been made and was entirely within the limits of practicability in the not very distant future. The adoption of a transformer in combination with a lighting fixture, permitting the use of a shorter, thicker filament, was suggested, and this has been considered quite feasible. Certainly the suggestion made by Dr. Sharp that a transformer with a number of taps might be placed on the panel board and low-voltage circuits used in the distribution throughout the house, is sensible.

Another statement which was brought out, in which considerable interest has been manifested, and concerning which further remarks are awaited with great eagerness, was in effect that very soon the central station companies would announce

a policy with regard to the use of the tungsten lamp. This policy, it is understood, will be one that will commend itself to every one interested as a broad-minded, fair-dealing proposition. There is no apprehension by central station men of the ultimate effect of these modern illuminants. The carbon and other types of lamps will be slowly displaced, if not for other reasons, because it will not be possible to manufacture enough tungsten lamps to retire the other types very rapidly. Approximately 80,000,000 lamps comprised the total output of incandescent-lamp factories in the United States last year. It is expected that the natural increase for incandescent lamps will amount to 20,000,000 for the present year. It will not be possible in all the tungsten-lamp factories now established to manufacture more than 1,000,000 tungsten lamps during the present year—a small proportion, only, of the normal increase in consumption.

PROPOSED ELECTRIFICATION OF THE AUSTRIAN RAILWAYS.

Trunk-line electrification has bright prospects, not only in America, but abroad. Italy, as is well known, has done a good deal of pioneer work in this direction; Switzerland, owing to the lack of coal and the abundance of water power, is hard at work developing a satisfactory plan for banishing the steam locomotive from the republic; Sweden has taken up the matter in earnest, and after some experimentation is about to electrify an important section of the state railways—there, also, in order to avoid the importation of coal and to make use of its water power; and now Austria is contemplating a similar undertaking in a serious manner. At a recent meeting of the Engineering Society of Vienna a paper upon this subject was read by Baron Volfgang Van Ferstel, chief of the Bureau of Electric Traction, which discussed the work already done and pointed out the advantages of the electrical system.

In Austria the reason for electrification is twofold. In the first place, although Austria has coal, she also has water power, and one object of the electrification is to conserve the coal and utilize the inexhaustible waterfalls. The supply of coal has an end, but the water powers will continue as long as climatic conditions are not changed.

The second reason for the electrification of the railways is the necessity for increasing their traffic capacity. Some of the Austrian railways traverse difficult country, hence the train loads are limited and the cost of operating the steam locomotives excessive. It is hoped that by electrifying these roads the increased capacity may be obtained without increased expenditures for permanent way.

The plans now under consideration in Austria contemplate electrifying about 2,000 miles of trunk-line system. One of the first sections which will be changed is the Arlberg tunnel, which is nearly seven miles long and through which passes a large traffic. The three-phase system is to be installed on this line, but the government is not yet definitely committed to any one system for all the roads.

THE EFFECT OF ELECTRICITY UPON PLANTS.

In the ELECTRICAL REVIEW of September 28, 1907, a paper, read by Mr. J. H. Priestley before the British Naturalists' Society, on "The Effect of Electricity Upon Plants," was commented upon. This paper gave an interesting historical sketch of the previous work in this general field and described some small experiments conducted by Mr. J. E. Newman, and, also, some experiments on a larger scale which were then being completed. The general conclusions drawn in this paper were that, although certain of the early experiments seemed to show a surprising effect of electrical stimulation, both when discharged into the air above the plants and when passed as a current through the ground, the later investigations, conducted on a larger scale, with forty acres under cultivation, half of which was treated electrically and the other half held as a control, seemed to show little or no good effect. There was, however, an indication that a disease which attacked the cucumber beds made less progress in the electrified portion of the ground than elsewhere. The surprising effect in certain of the earlier experiments, the cause of which has not yet been explained, as well as the really small amount of experimental investigation in this field, call for more elaborate experiments, conducted, if possible, under as many and as varied conditions as could be secured. For instance, in one of the sets of experiments it was found that the electrified beet-sugar beds not only produced thirty-three per cent more beets than those not electrified, but that the beets from the former contained over fourteen per cent more sugar than the latter. The total increase in sugar in the electrified plot was, therefore, nearly fifty-two per cent as compared with the unelectrified plot. The possibilities of securing any such results in actual farming should induce a number of agricultural experiment stations to institute similar investigations, so that the results of experiments conducted in widely scattered districts may be compared and a more definite idea secured of just what effect, if any, electrification does have. Such a surprising increase as was found in this case suggests that there were other unrecognized factors bringing about, or contributing to, the results, a conclusion which is upheld by the negative results of the later experiments. But the latter may, also, have been influenced adversely in some way. The only way to get at the true state of affairs is to make a systematic investigation of the entire field.

When the paper referred to above was first commented upon the whole text was not available. This, however, appears in the Proceedings of the Naturalists' Society, of London, and contains a good many interesting details necessarily omitted from the abstracts previously published. Of particular interest are the theories advanced to explain the physiological action of the electrification. One suggestion, which has been referred to previously, is that the current brings about an osmotic effect which tends to draw water up to the roots of the plant. It has even been suggested that this effect may be exerted upon the plant itself and assist in forcing the sap up through the cells. As opposed to the latter suggestion, it may be said that if the stimulation

of the roots acts to drive the sap up to the leaves, the stimulation of the leaves might act in the reverse direction, and hence be detrimental. There is no experimental evidence of any such action taking place. Bose thinks that the electrical discharges act by directly stimulating the plant—a rather indefinite idea, as one wonders upon what part of the plant the stimulation takes effect and how it acts. There is, of course, one effect which most certainly takes place to a greater or less extent—that is, an electrolytic action can be brought about in the earth. This change has probably been of small amount in all experiments which have yet been conducted, but even this might be valuable, since it is produced when and where needed, provided, of course, the change is a desirable one. Another suggestion of similar character is that overhead discharges may bring about the oxidation of the atmospheric nitrogen and thus supply plant food. These ideas could easily be checked by supplying the product produced by the electrical current in some other way and thus determine whether it is this, or some other action, which affects the plants. Various other chemical actions have been suggested, but little or no experimental investigation has been made to test them. One explanation suggested by Lord Kelvin is that the good results found in certain of the experiments were due, not to the current, but to the turning up of the ground in order to bury the wires. This brings to mind the old story of the lazy farmer who dreamed of a pot of gold buried under one of the trees in his neglected orchard. Not remembering which tree was the one, he dug around all of them before finally being satisfied that the gold was not there, but he found his treasure in the fall in the magnificent crop his trees bore. In line with this idea there is the theory held by some agriculturists that nearly all soils contain sufficient nourishment for the crops, provided this is made available by thorough cultivation. Fertilizers merely take the place of cultivation, giving in more available form what the soil would furnish if properly treated. From an engineer's viewpoint, however, even if this theory be true, the use of fertilizer is justified if it is cheaper in the end than equivalent cultivation. In the same way electrical stimulation may be found to give no better results than careful cultivation, but if it should be found cheaper than the latter it would be good practice. Hence the experiments conducted in this field should be carried out under all possible conditions with the object of obtaining the most valuable crops for the least cost and smallest deterioration of the soil.

There is another reason why experiments in this field should be of much interest. We are learning a number of surprising facts about the electrical condition of the air, and if, as many believe, this natural condition directly acts upon terrestrial life why should we not be able artificially to increase this effect and thus improve the results if beneficial? A difference of potential of about 100 volts for each foot difference in altitude may be expected to influence in some way vegetable life, even though the air does not give up its charge readily. But it has not yet been definitely shown that any electrical treatment is good for any kind of plant life.

ELECTRICAL POWER IN FRANCE.

We are apt, in this country, to think that we are far ahead of all foreign countries in the application and utilization of electric power, but there are a few foreign countries which are, let us say, not very far behind us. The long-distance transmission systems of the Pacific coast are certainly unsurpassed in the world, but there are systems comparable with these in Europe. For instance, in southern France a most important transmission system has been built up during the past nine years, starting with the development of a water power in the Pyrenees. This is the system operated by the Société Meridionale de Transport de Force, which put into service, in 1899, its station at St. Georges, on the Aude River. This system was described in the ELECTRICAL REVIEW some years ago, but since then it has increased notably; in fact, before any one extension has been completed, conditions have arisen which necessitate still further increases, so that now three new powerhouses have been put into service to supplement the first section.

In studying this remarkable development one is struck with the elaborate network of transmission lines. It should be said that, with one or two exceptions, the transmitting company limits its activities to the transmission of power only, delivering this to various local organizations which establish substations and distributing systems in their own districts. In this way the transmitting company is left free in the development and transmission of power, and has thus, no doubt, been able to extend its system more rapidly and widely than would have been the case if it had been forced to invest a large amount of money in the secondary and tertiary distributing lines and stations. The company has now over 375 miles of high-tension lines, including lines operating at twenty and at five thousand volts. In addition to the main generating station and the three secondary stations, which were originally converting stations, but were supplied with steam engines in order to provide against contingencies, the company is supplying power to about a hundred substations, from which it is distributed for use in a very large number of industries. These include sawmills, pulp mills, ice factories, irrigating systems, besides lighting, traction work and the more ordinary uses of electric power.

The fact that, in making up several recently appointed public service commissions, the engineering fraternity has been overlooked has led to considerable discussion of this matter, which is more or less crystallized in the paper presented by Mr. Henry Floy before the American Institute of Electrical Engineers last week, an abstract of which and of the discussion thereon appears elsewhere in this issue. Notwithstanding the competent engineering staffs supplemental to the commissions, it is generally agreed (except among the lawyers) that an engineer of wide technical knowledge and experience taking an active and responsible part in the final deliberations of the commission would serve to render invaluable aid in foreseeing the technical result of the regulations ordered, and sometimes, therefore, avoid asking the practically impossible.

The Engineer's Activity in Public Affairs—Public Utility Commissions and Franchise Valuations.

The 227th meeting of the American Institute of Electrical Engineers was held in New York city, in the Engineering Societies Building, on April 10. The subject for discussion was a paper presented by Henry Floy, entitled "The Engineer's Activity in Public Affairs—Public Utility Commissions and Franchise Valuations." An abstract of this paper follows:

It is beginning to be recognized that a corporation must not only serve the public but also the stockholders; that the public can not be served by corporations unless the stockholders receive a return on their investment concomitant with the risk; that capital can not be compelled to invest on terms unacceptable to it. This change of sentiment, however, does not mean, as is clearly evident to the well-informed engineer, that the public will ever again return to its former *laissez faire* policy toward corporations.

Just at this time, during this important readjustment of relations between the public and the corporations, it is proper, yes, necessary, that the engineer should pause to consider the lessons to be learned from recent experience, formulate his opinions for the future, and thus be the better prepared to co-operate in ending the present feeling of unrest and antagonism and share in the successes of the new advance which is sure to begin soon. Although by education, training and experience the engineer is presumably well-balanced and not excitable, he may nevertheless be influenced by popular sentiment or the demands of the corporations or financiers. During this transition stage especially, when the demands upon his time are restricted, he should take the opportunity to verify his opinions, re-establish his conclusions and calmly determine his future line of action.

Considering the importance of the real work done by the engineer in the recent commercial development of this country, the comparatively unimportant public part taken by him is rather striking.

As a result the engineer has hardly received the public recognition which would be expected. Perhaps the most striking recent illustration of this was in the appointments made to the two public utilities commissions of the state of New York, which included fourteen high-class, well-paid officials. Of this number only one has had a technical training, although in the hands of these commissioners are placed, with almost despotic power, the affairs of large engineering enterprises in the state of New York, estimated to be valued at about $3,500,000,000.

It is well known that the House of Lords in England, when it sits as a Court of Appeals, has the cases submitted to its law members, which would seem to be the only rational practice. Contrary to such general belief, the opinion prevailing in selecting the New York state commissioners, as indicated by their appointment, was that if they possessed unquestioned integrity there existed no special reason for naming men experienced in handling engineering or transportation questions. This has resulted in the necessity of hiring engineering subordinates, which increases expenses and decreases direct responsibility, because the advice of more or less independent experts reporting on matters of detail is quite different in value from the advice given by a technical member of a board identified with its policy and responsible to the public for the discharge of his obligations. Hired experts can never be made to shoulder the responsibility for a decision rendered by a commission composed wholly of men untrained in public utility affairs and perhaps unable fully to appreciate the technical effect of their orders.

By reason of the work and position of the engineer in the business and technical world, is it not reasonable to expect that at least one-half of the membership of the public utility commissions being named from time to time throughout the country should be composed of experienced, broad-gauge engineers? I venture to prophesy that as public service commissions become more common they will be constituted more and more of men drawn from the ranks of those having practical experience with the work to be undertaken. In fact, I can conceive of no more independent, dignified, influential or beneficent occupation in which an engineer can be engaged, and I believe the honor of the position will utimately attract to it our most capable men whom now the monetary inducement will not interest.

The commercial importance of the engineer is steadily growing, and he should recognize the claims upon him to take part in public affairs and assume the responsibility more and more laid upon him of leadership. His increasingly closer business relations with public matters and his reputation for integrity give his opinion and influence steadily greater weight in large affairs, which he should appreciate, accept and respond to. While the engineer's work must always be professional, in a way judicial, and should always be accompanied by high moral sense, the successful engineer must nevertheless combine practical business qualifications with the scientific work. There can be no good engineer—in a broad sense—unless combined with his technical conclusions there is included such recognition of commercial conditions, as will thereby permit him to attain the worthy objects of his chosen profession with maximum efficiency.

The aggressive, almost insolent, and ofttimes unfair, attitude of some utility corporations has created an insistent demand for further and more direct control of operations than has been possible through the more usual form of legislative enactments. The American people are not, as a rule, over-inquisitive as to somebody else's business, but when imposed upon they do not hesitate to ascertain the why and wherefore. The result has been a publicity of corporation finances and affairs that now implies an obligation to afford the corporation legitimate protection in its business.

New York started in a mild way with several commissions for different purposes; but last year, under the leadership of Governor Hughes, the state passed laws substituting for the other commissions, two state commissions, one to have charge of all public utility corporations in Greater New York, and the other in the remainder of the state. To these two commissions were delegated almost unlimited authority, they having power to examine corporation affairs as completely as any board of directors, and to require changes in methods of operation, and even reduction in prices charged for service.

Other states are following the precedent established by Massachusetts and New York. Wisconsin already has such a commission appointed under an act of the legislature, which is well worth perusal by any one desirous of learning the present-day radical trend of opinion. There is little doubt that before long, *nolens volens*, most or all the states in the Union will have commissions appointed to control and regulate at least the so-called public utility corporations. That such commissions have the right and power to determine rates, has been established in New York state by the courts, in the Saratoga case.

With regard to operation, public utility commissions should restrict their action to general principles; they should not interfere with details, otherwise they will remove the present responsibilities from the shoulders of the directors to their own shoulders, restrict and hamper the efficiency of the organizations, still the incentive to work, and destroy the reasons for promotion of the employés—all of which will result in depreciating the service rendered the public and the financial standing of the corporations themselves.

If state regulation is to determine rates and limit the earnings upon investment, it may logically be asked, should the state not also include a guarantee of reasonable returns on the investment? If a corporation takes all the risks, it is logically entitled to all the profits. If the state prohibits anything more than a definite profit, may it not be morally bound to assure that profit? In fact, municipalities have been known to go a long way in this direction by granting an exclusive franchise, which affords a monopoly and prevents competition.

Confiscation means the taking of property without allowing "fair return" thereon. Fair return is a smooth legal term which neither the courts nor any one else has yet been able precisely to interpret. In the decision of the United States Circuit Court in the Columbus case, an un-

allowed demand for a reduction in electrical rates, a decision with which every engineer interested in public utilities should be acquainted, it was stated that, over and above legitimate operating expenses and depreciation charges:

"The owner of the property should be at least permitted to receive as his compensation for its use the legal amount of interest allowed by the state of Ohio."

The court then goes on to say:

"It may well be doubted whether the legal rate of interest is reasonable and just compensation to the owner of the property devoted to public use, etc. . . . It may well be doubted whether capital would at any time for this legal rate alone be willing to enter upon the rendition of public service of the kind performed by the complainant under these circumstances and conditions, etc."

Again, in the famous case against the Consolidated Gas Company of New York, in which a reduction was sought from $1 to eighty cents per 1,000 feet of gas, the court has held that the owner is entitled to "a fair return upon the reasonable value of his property," which is guaranteed to him by the famous fourteenth amendment to the Constitution.

In considering the expenses and profits of a public-service plant, the engineer must determine the proportion of earnings to be applied to taxes and dividends, the amount of both of which will usually be affected by the value of the company's franchise. At present the franchises of different corporations are variously valued at from less than nothing, or a liability, up to a $20,000,000 asset. Therefore, the competent public corporation engineer must understand what a franchise is, its dollars-and-cents value and its distinction from the good-will of a going organization, favorable contracts, or physical property.

A franchise is a license, granted by a state or municipality, recognizing the right of a public utility corporation to do certain business along prescribed lines. As the privileges and earning power of franchises vary, so their values vary. On one extreme it has been argued that because a franchise costs nothing, or is supposed to cost nothing, it should not be valued or capitalized by a corporation—the present New York statutes prohibit capitalization of franchises by new corporations—because then the public is forced to pay, by increased cost of service, the fixed charges on what they have themselves once owned and gratuitously bestowed. The corporation replies that its franchise is regularly and heavily taxed. If it has no value, it can not fairly or logically be a subject for taxation; if it has value, it can and should be capitalized. The answer made to this is that the franchise tax is included among the items which go to make up the proper selling price of the corporation's product, and therefore is indirectly paid by the customer without in any way affecting the stockholders' investment or profit.

On the other hand, as the engineer well knows, franchises are frequently granted as a sort of bonus to induce capital to undertake, perhaps at a loss at the start, certain operations for the benefit of itself and the public. One purpose in accepting such obligations has been, not immediate return, but the profits to be gained in the future by the growth of the town or state and the consequent increase in revenue. As time goes on, the value of the franchise increases the same as real estate or a desirable business location, and it would seem might be just as logically recognized as of value and capitalized.

Aside from feeling or argument in the matter, the courts have held, and will doubtless always hold, unless it is expressly excepted, that a franchise is property and a more or less valuable asset. If, then, the franchise is property, what may be the value of the property? The present secretive, uncertain, inequitable, unscientific method of arriving at the value of each corporation's franchise, as practiced by the state of New York, for example, is, to use the language of the courts themselves, "little more than a guess," and should be replaced by something simple, logical, uniform and publicly determinable.

An examination of the values placed on many franchises in the past for purposes of taxation, capitalization, condemnation or court decision, will indicate that perhaps an average valuation of the franchise in each case is not far from one-third of the actual replacement value of the corporation's assets. This ratio, though somewhat arbitrarily assumed, would seem under present circumstances to be both a fair and reasonable one for existing franchises. If it is a middle ground on which the various conflicting interests could meet, we will have an automatic, easily determinable, open and above-board method of evaluating franchises. As will be recognized, the proposed method gives a different value to the franchises of different companies, but is equally fair to all because based on their tangible value; it will also be seen that the value of the franchise of a given company may vary from year to year, depending upon the value of their property. Both of these variables are essential in a franchise valuation.

EXAMPLE ILLUSTRATING "FAIR RETURN" FOR NEW YORK CORPORATION.

Life of franchise	20 years.	Perpetual.
Cash investment or replacement value	$300,000	$600,000
Capitalization of franchise at thirty-three per cent	100,000	200,000
Total capitalization	$400,000	$800,000
All operating expenses, forty per cent to fifty per cent gross	$36,000	$96,000
Maintenance and repairs, seven per cent on sixty-six per cent investment	14,000	28,000
Depreciation fund, five per cent on sixty-six per cent investment	10,000	20,000
Amortization on franchise value, five per cent	5,000	.....
Interest on total capitalization, six per cent	24,000	48,000
Gross income	$89,000	$192,000

In making up the annual operating and fixed charges of a corporation, it is proposed that the state commission should consider the value of the franchise, as determined above, allowing the legal rate thereon and also a further amount for depreciation or amortization, depending upon the life of the franchise. This latter figure, in the case of a perpetual franchise, would be nothing; but in the case of a short-time franchise would be a very appreciable amount, which of course must be paid by the public. The economy of a perpetual franchise, which the companies desire, will be appreciated, and there is no great objection to it, provided its owner is properly restricted so as to safeguard the public interest. To illustrate the foregoing, let us consider a concrete example of a New York corporation which has been granted a liberal franchise for a period of twenty years, and has invested $300,000 in order to establish a going business, compared with a similar corporation having a perpetual franchise and an investment of $600,000. For more fully illustrating conditions as found, we will assume that the general operating expenses in the first case are forty per cent of the gross income and in the second case fifty per cent, due to differences in apparatus installed and efficiency of management. Repairs and maintenance will be taken at seven per cent and depreciation at five per cent.

If the gross income exceeded the above figures, the price of the corporation's product should be reduced proportionately to a prearranged increase in dividends, in accordance with the London scale or a modification thereof. If the gross income were less than the above, it would be proper to increase the price of the commodity, as was authorized, for example, by the Wisconsin Public Utilities Commission in the case of the La Crosse Gas and Electric Company.

It will be noticed from the above example that in a different state, with a different legal rate, the returns allowed on the investment, and consequently the gross income allowed, would be different. This is as it should be, because the rate of return varies in different parts of the country, as is recognized by the various legal rates in the different states.

The meeting was presided over by A. H. Armstrong, vice-president, who called upon George S. Coleman, counsel for the Public Service Commission of the First District, state of New York.

Mr. Coleman stated that there was only one point upon which he agreed with Mr. Floy; that was that engineers, as a rule, were too modest and did not take a prominent enough part in the general activities of the political world. Where projects involved matters in which engineers are supposed to be expert they should be heard at the public meetings and should take a voice in formulating the methods of procedure in developing these enterprises. He did not agree with Mr. Floy that a public service commission should

be composed of engineers. While he admitted that there were engineers possessed of the necessary qualifications, still the commission is the product of a legislative body and stands for the community as a whole. A public service commissioner should, first of all, be a man of undoubted integrity; he should be broad-minded, patient, thorough-going, honest, and, best of all, possessed of thorough good judgment. The present Public Service Commission for the First District of the state of New York has a preponderance of lawyers, and this insures that no decision will be arrived at without full discussion. He thought that the public utilities commission was served by most excellent staffs of engineers. These staffs of engineers were entirely competent to deal with the questions involved and report to the commissions, whose orders are formulated as the result of analyses of these reports. He did not think that regulation should stop where operation commenced, because in that case a great deal of the regulation, such as the improvement in running schedules, the vestibuling of cars, the proper ventilation and sanitation of conveyances, would hardly be carried out effectively. Notwithstanding the fact that very little is heard of actual improvements accomplished, it is a certainty that, in a quiet way, a great many very radical improvements have been effected.

Concerning the matter of franchise valuation, it was very hard to arrive at just definitions and equitable considerations. Even the courts, in their most recent decisions, showed a very wide range of opinion on this difficult question. Too often, in estimating a franchise valuation as it affects stock capitalization, the fact that there must always be a large amount of lost capital in going enterprises of any great life is lost sight of. It does not follow that even if a corporation has invested an immense amount of money, and this investment has been entirely replaced by new equipment, that it should earn a dividend upon the total investment. He pointed out a case where, not so many years ago, a corporation was doing very nicely as a horse railroad system. This was, in time, replaced by a cable system, and very shortly after the system was entirely electrified. The expense involved in the transition from horse to electric traction amounted to about $26,000,000, but the most liberal appraisement of the electrified system, including all essential details, represented a capitalization of less than $12,000,000. The difference between the investment and the appraisement was apparently lost capital.

Concerning essential monopolies, there was no doubt that competition meant annihilation in many cases, higher rates and wasteful methods. Competition certainly was not the panacea to-day that people imagined it was not so long ago. It could be conceived that in a city like New York or other large cities, one great traction company, one great electric lighting company, one great gas company, could, if properly regulated, best serve the interests and convenience of the public.

Charles F. Lacombe, chief engineer, Light and Power Department, of the Department of Water Supply, Gas and Electricity, New York city, thought that it would be well to have a representative of wide engineering and practical experience on the public service commissions. The title and dignity of commissioner, added to the remuneration, would attract the best engineering talent, and, to his mind, strengthen the hands of the commissioners and make their work more efficient. It would also cut down a great deal of expense, both of time and money, if there was a good engineer who could grasp the situations as they were presented by engineers and keep ever before his fellow-commissioners the fundamental laws of nature which must not be violated in asking for the impossible. It has been said that very little good was being effected through the agency of the public service commissions, and that furthermore the corporations were so arranging their policies that there was no need of this regulation. The answer to this would seem to be along the same lines as might be pointed out with regard to the criminals of the world. Because the majority of people are honest and good it does not stand to reason that laws and penalties should not be put into effect to punish the criminals. The majority of the honest must be protected against the criminal inclinations of the few. In reference to several enactments which had been made by commissions, Mr. Lacombe pointed out that if an engineer had been a member of the commission it was quite possible that the city would have been saved a great deal of expensive litigation. With regard to the eighty-cent gas bill, one of the enactments made it imperative upon the company to maintain a pressure of not less than one inch nor more than two and one-half inches at any point in its distribution system at any distance from its source of supply. The profile of Manhattan Island and the height of the gas column made it impossible to work at the lower pressures in certain places, and in other situations it was impossible to use mantle burners and get sufficient pressure to use gas cooking stoves on the higher limits. The penalty for each violation as enacted by the bill was $1,000. As near as he could remember, if these penalties had been acted upon by the law departments of the city, they would have amounted to considerably over a million dollars over a year ago. Another absurd clause in the act penalizes the gas company $1,000 for each bill that it may render to the city charging more than seventy-five cents per 1,000 cubic feet of gas. During Mr. Lacombe's term of office he had returned bills in which mistakes had been inadvertently made by the gas company, the penalties upon which would have amounted to $25,000, while the bills did not call for the payment of more than $5,000. To be effective, the enactments of the public service commission must be logical and reasonable. There are many demands which apparently are just, which, when subjected to the light of analysis, in view of working conditions, are certainly not possible of performance. It is quite possible that if an engineer had been a member of the commission which caused to be enacted the eighty-cent gas bill, the city might have saved the cost of the litigation; and if a sliding scale had been adopted, the larger sales of gas which would have resulted would have prompted the companies to voluntarily make a substantial reduction in the cost to the consumer.

Henry Morton Brinckerhoff emphasized a few general principles which he thought should be considered in connection with any contention among the public service corporations, the public and the public service commission. The interests of the companies and the people are so closely interwoven that every element should be taken into consideration. Regulation should not mean stopping and checking; it should have just as much to do with acceleration as it has to do with retardation. There should be a hearty sharing of responsibility between the corporation and the commission. If any engineer has ever been in a position where he has had occasion to go out upon a road where a wreck has occurred and assist in removing the maimed and injured, and possibly the dying, he knows what it is to feel that the public and the state are sharing his responsibility. If he knows that only recently his system has been inspected and

has been found to have every safeguard which human ingenuity can devise, his position is far better than that of the man who knows that he has violated some of the first principles of the responsibility which rests upon him as an operating man. To attain its greatest usefulness the commission should have among its members men of wide practical experience and great technical knowledge. It is equally important that it should have men of executive ability and men with judicial minds: the commission should be balanced. One of the greatest weaknesses of the public service commission composed entirely of lawyers or of men with executive minds is that, even though they may be impressed by the testimony and evidence of engineers and by the reports presented to them by engineers, in their deliberations they are not capable of appreciating the full value and the absolute meaning of such testimony and such reports, and can not fully realize the results of the execution of the orders they issue. He thought that the national engineering societies would do well to promote the idea of having men upon the commissions who had had this practical experience. Engineers are apt to consider themselves in a class apart from the ordinary citizen. This was wrong, and the sooner the engineer took an active part in the policies and politics of the day, the sooner would his work be appreciated. Until that day arrived and until the engineer was recognized as an essential factor in the development of the whole fabric of city and state government, he could not see wherein existed real representative government.

A contribution was read from Louis A. Ferguson, vice-president and general manager of the Commonwealth Edison Company, Chicago. He agreed with Mr. Floy that experienced engineers should be among the members of the public service commission. It was a brighter day for the operating company when regulation was placed in the hands of high-minded, intelligent, honest commissioners. Where city councils or boards of aldermen or legislatures composed of large numbers of warring elements attempted to regulate rates and methods of operation, the probability was, and always would be, that the questions would involve years of discussion, interminable hearings, and result in measures that were merely compromises, and under which both the company and the public were losers.

Concerning the matter of a fair return, the question might be very tritely asked, What is a fair return? Certainly the legal rate of interest—five per cent—in the state of Illinois is not a fair return. There is no magic in public service corporations which will interest capital if it is not foreseen that there will be a decent return upon the money put to risk. Where the corporation lives in daily danger of having its equity swept away by radical legislation or unintelligent control, capital can not be interested. The return must be the equivalent of that which can be earned in other lines of business. There is no doubt that competition is disastrous in the long run to both the corporation and the public. Essential monopolies in public utility corporations, properly regulated, best serve the interests of all.

Henry L. Doherty contributed a communication in which he said that the presentation of a paper on such a subject before the Institute was an interpretation of the broadening scope of engineering endeavor. This was a period of marked antagonism to public service corporations, but in many directions the antipathy was due, in large measure, to imaginary grievances. Wholesale municipal ownership would result in nothing less than disaster, but properly directed control need result in neither disaster nor retardation. Public control should be automatic, and the company should be premiumized for every improvement in service.

Frederick C. Bates pointed out to the members first of all the importance of the engineers attending more strictly to their duties as citizens. It was no use leaving the matter of sending men to the legislature to the practical politician and to the other fellow, and then finding fault with the legislation enacted. The first duty of the engineer as a citizen was to attend his primaries and his elections and assist in sending to the legislature the best men available for the positions. It followed that the citizen could have some control over the legislation enacted.

W. W. Freeman, vice-president of the Edison Electric Illuminating Company of Brooklyn, said that he had no apprehension in having the commission formed of broad-gauge business men who would view the situation aside from a technical standpoint. With regard to franchise valuations, he did not think that engineers should be committed or should in any way endorse the idea that one-third of the capitalization represented the franchise valuation. If a value were put upon a franchise for taxation, and it was equitable to put this same value on the franchise for purposes of capitalization, there would be no danger of the value being too low; but the consideration must be equitable. It is not reasonable to assume that the income of a company should be measured by what might be considered a proper distribution to its stockholders, whether that be six per cent or eight per cent, or any other per cent. Beyond the distribution to its stockholders the company should be assured a liberal amount for reserve. The theory that the company can only earn a proper return for distribution to its stockholders is ruinous. The company must earn in the good times and place to reserve an increment which will allow it to work as a going concern and carry on its extensions in the periods of depression.

Following the discussion, a suggestion was made to refer the matter of forming a public policy committee, to look into the question of having engineering representation upon the public service commissions, to the directors of the Institute.

The meeting was then adjourned.

The Iowa Street and Interurban Railway Association.

The fifth annual convention of the Iowa Street and Interurban Railway Association will be held at Des Moines, Iowa, Thursday and Friday, April 23 and 24. Headquarters will be maintained at the Savery Hotel. The following programme has been announced:

Thursday, April 23, morning session: Convention called to order at 10 A. M.; address of welcome, Mayor A. J. Mathes, Des Moines; response, C. E. Walters, Toledo; address of president; reading of minutes; report of secretary and treasurer; paper, "Reinforced Concrete in Electric Railway Construction," N. M. Stark, Des Moines. Afternoon session: Paper, "Depreciation," Daniel Royce, Chicago; paper, "Claims—Methods of Handling Same by Electric Railways," Arthur W. Gross, Omaha.

Friday, April 24, morning session: General discussion on advertising by electric railways; paper, "Handling Fares on Interurban Railways," P. P. Crafts, Clinton. Afternoon session: Paper, "Interstate Commerce Commission—Statistics and Accounts," C. L. Wight, Des Moines; executive session; report of nominating committee; election of officers; adjournment.

The officers of the Iowa Street and Interurban Railway Association are: F. J. Hanlon, Mason City, president; P. P. Crafts, Clinton, vice-president; L. D. Mathes, Dubuque, secretary and treasurer.

"Surges and Oscillations in Transmission Systems."

At the meeting of the New York Electrical Society, held on the evening of March 27, Ernest J. Berg presented a paper on "Surges and Oscillations in Transmission Systems." The first part of the paper dealt with high voltages and currents of very short duration, due to interrupting or establishing electrical circuits. The energy available in these disturbances is proportional to the length of the transmission, but the voltage is independent thereof. Since the natural frequency of a transmission is higher the shorter the line, it is evident that the higher the frequency the less energy is involved, so that very high frequency disturbances represent little energy. As an instance of the amount of energy stored in a line, Mr. Berg quoted a case of a 150-mile transmission operating with 60,000 volts, in which case the electrostatic energy is about 1,000 joules or watts per second, representing approximately the energy stored in a few drops of gasolene.

It was shown that in closing the transmission line on the generator the instantaneous rush of current might well be many times full-load current, consequently, in large systems, and particularly in cable network, it may be advisable to use resistance in circuit with the system at the moment of first closing the switch.

The maximum rise in voltage that can occur in closing a circuit is double the impressed, whereas, the voltage that may occur in opening the circuit is often several times that value and is proportional to the instantaneous current at the time.

Mr. Berg gave some diagrams in which the high voltages incidental to connecting a transformer to a line were shown.

When the transformer was connected through an air switch the voltage across the winding was three times the normal, and the voltage across a few end turns ten to fifteen times that under normal operation.

The second class of phenomena discussed were abnormal voltages of long duration, which usually manifest themselves in so-called "statics," usually caused by a grounded transmission line. It was shown that the larger the electrostatic capacity between the primary and secondary of the step-up transformer, as compared with the electrostatic capacity between the generator winding and generator frame, the less serious would be the statics.

In connection with a ground on a transmission line the disturbances caused in telephone circuits were discussed to some extent, and various arrangements to minimize the danger were brought out.

The undesirability of running several sets of generators, transformers and transmission lines independently from each other, that is, not synchronized, was brought out, and it was shown that under such conditions the stresses on transformers and apparatus in general might readily be three times the normal.

A simple explanation was given of the cause of the triple frequency current in closed delta, delta-connected transformers, and it was shown that if such current could not flow, for instance in the case of Y-Y connection, triple frequency electromotive forces would be found between any of the lines and ground. Unless this electromotive force was considered, very considerable stresses might be impressed on the system by the indiscriminate choice of transformer connections, although these transformer connections may give the right ratio of transformation.

It was shown why arcing grounds are much more serious than positive grounds and suggested that whenever a ground occurs it might be well to make a definite ground in the station until such time as the accidental ground has been detected and overcome.

The practical effect of the familiar phenomena of corona was discussed and it was shown that the diameter of the wire in high potential systems is often much more important than the amount of insulation, in order to secure satisfactory protection.

The following new members were elected:

Clark Potter Read, James W. Owens, J. Allan Worth, Dr. Albert C. Geyser, Joseph W. Lowell, Clarence T. Coley, Bernard Elias, James J. Burnes, Albert C. Triaca, John C. Lotz, Edwin N. Lightfoot, William Leo. Culley, Ray M. Telford, A. Schwennesen, Chas. F. de Soria, Burtis D. Mack, New York city.

Electrical Firms Suffer Damage by Fire.

During the past week several very prominent electrical manufacturing companies suffered more or less through fire either in their office headquarters or at the factory. The Phœnix Glass Company, the well-known manufacturer of the Phœnix inner globes and glassware for decorative lighting, and the Yale & Towne Manufacturing Company, manufacturer of electric hoists and other factory and industrial apparatus, both located in the Franklin Building, 9-15 Murray street, New York city, suffered from fire and water from a conflagration that ran through the building.

In the disastrous fire which swept over Chelsea, Mass., the factory of the American Circular Loom Company was damaged.

The firms involved have taken immediate steps to effect prompt deliveries.

Important Amalgamation of German Wireless Patents.

The appellate division of the German Patent Office has within the past few days handed down an interesting decision affecting the future development of wireless telegraphy and telephony.

The decision has reference to the "Lichtbogen-Unterbrecher-Patent" of the well-known Berlin inventor, Ernst Ruhmer, which materially affects the Poulsen system for the propagation of continuous electrical waves.

The Amalgamated Radio Telegraph Company, which is developing the Poulsen system, admits that several Poulsen stations are working under the Ruhmer system.

The German Poulsen patents relating to electrical wireless telegraphy and telephony and the German Ruhmer patents relating to electrical "Lichtbogen-Unterbrecher" have within a few days become the property of the C. Lorenz Actiens Gesellschaft, Berlin, which will develop the patents in Germany. This amicable arrangement will prevent the contest between the two inventors which was feared.

Westinghouse Electric and Manufacturing Company.

The British Westinghouse Company has arranged its finances by the sale of prior lien debentures, effecting an important reduction in the Westinghouse Electric and Manufacturing Company's liability. The Russian Westinghouse Company has also made large payments on its indebtedness to the American company. The British Westinghouse Company has effected the sale of $1,250,000 out of an issue of $1,500,000 of prior lien debentures, providing for all of its debts and a cash surplus for its requirements. The Westinghouse Electric Company, Limited, of London, acting as agent of the American company, had discounted Westinghouse company bills given to the British company prior to the appointment of receivers for the American company, amounting to $70,000, which has since been paid by the Russian company. The British Westinghouse Company has fully provided for its indebtedness of $743,135. The Russian company has also paid $95,000 on account of its overdue notes, aggregating $500,000, and has agreed with the banks holding the notes to pay the balance this year. These two payments, aggregating $165,000, are in addition to payments aggregating $246,139 made by the Russian company to the French Westinghouse Company at about the time of the appointment of the receivers for the American company. The total reduction in the indebtedness of the Westinghouse Electric and Manufacturing Company as of October 23, secured by the payments enumerated above, is $1,154,274.

FINANCIAL REPORTS OF ELECTRIC COMPANIES.

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company, of Philadelphia, Pa., for February and eight months compare as follows: February gross, 1908, $86,241; 1907, $82,-687. Expenses and taxes amounted to $45,042 and $41,168; February net to $41,199 and $41,519. Eight months' gross, 1908, $698,823; 1907, $647,085. Expenses and taxes, $369,643 and $349,-005. Eight months' net, $329,380 and $298,080.

PIONEER TELEPHONE AND TELEGRAPH COMPANY.

The gross earnings of the Pioneer Telephone and Telegraph Company, Oklahoma City, Okla., for the twelve months ended December 31, 1907, were $1,125,388, against $772,729 in 1906. Net earnings were $189,420, against $61,108. There was a surplus, after dividends, of $63,-945, against $6,000. The net earnings were equal to 7.6 per cent on the $2,468,-300 capital stock. Over three-quarters of a million dollars was expended on new construction.

BUTTE ELECTRIC AND POWER COMPANY.

The Butte (Mont.) Electric and Power Company's report for February and two months ended February 29, 1908, compares as follows: February gross, 1908, $101,975; 1907, $80,377. Expenses, $49,-953 and $50,494. February net, $52,-022 and $29,883. Two months' gross, 1908, $192,372; 1907, $176,782. Expenses, $77,747 and $72,877. The two months' net for 1908 was $114,625; other income, $120,278; charges, $47,642; balance, $72,636; applied to sinking fund, $1,277, making the surplus for two months $71,365.

The stockholders of the Butte Electric and Power Company have approved a proposition to issue $5,000,000 of thirty-year six per cent bonds. The bonds will be secured by a second mortgage on the properties of the Butte Electric and Power Company and its subsidiaries, the Madison River Power Company and the Montana Power Transmission Company. The proceeds of the sale of the bonds will be applied to liquidating the floating debt of the companies and providing additional working capital.

BELL TELEPHONE COMPANY OF MISSOURI.

The report of the Bell Telephone Company of Missouri for the year ended December 31, 1907, shows gross earnings of $1,937,482; expenses, $1,392,501; dividends, $416,368; surplus, $128,613. At the end of the year the company had a total of 45,279 stations. The expenditure for maintenance during the year was $465,476.

CANADIAN WESTINGHOUSE COMPANY, LIMITED.

The annual report of the Canadian Westinghouse Company, Limited, shows net profits for the year ended December 31, 1907, amounting to $427,053, an increase over the previous year of twenty-three per cent. Dividends paid during the year were $215,221. After a reserve for depreciation of $200,000 and reserve for inventory of $20,000, the balance carried forward to profit and loss on January 1, 1908, was $391,284. Unfilled orders on hand December 31 amounted to $1,136,-000.

Directors and officers have been re-elected.

THE LOUISVILLE RAILWAY COMPANY.

The annual report of the Louisville Railway Company, of Louisville, Ky., for the year ended December 31, 1907, shows gross earnings of $2,510,734; expenses and taxes, $1,696,004; other income, $85,-467; charges, $368,126; surplus, $532,-071; dividends, $496,737; surplus after dividends, $35,334; for depreciation, accidents, etc., $16,327, making the surplus for the year $19,007. This compares with a surplus of $12,705 for 1906. The gross for 1906 was $2,523,343. The charges for depreciation, accidents, etc., for 1906 were $70,000. The dividends paid represent five per cent on the preferred and three per cent on the common in 1907, against four per cent in 1906, when the dividends amounted to $596,706.

CHICAGO CITY RAILWAY COMPANY.

The Chicago (Ill.) City Railway Company, in its report for the year ended January 31, 1908, shows gross income of $10,560,571; expenses, $7,392,400; interest, averaging five per cent on the valuation, $1,566,159; surplus, $1,602,-012; fifty-five per cent paid to the city, $863,350; net surplus, $738,662.

RUTLAND RAILWAY, LIGHT AND POWER COMPANY.

The Rutland (Vt.) Railway, Light and Power Company, in its annual report for the year ended March 31, 1908, shows total net income of $110,456. The report for the different branches of the service is divided as follows: Railway company—gross, $105,485; expenses, $58,213. Gas company—gross, $34,717; expenses, $22,-239. Water, power and electric light—gross, $114,633; expenses, $63,927. Gross for all companies, $254,835; expenses, $144,379.

MICHIGAN STATE TELEPHONE COMPANY.

The report of the Michigan State Telephone Company for the year ended December 31, 1907, shows gross income of $3,092,227; expenses, taxes, etc., $2,-044,973; special expense and bond discount, $28,475; interest, $414,776; surplus, $604,001; dividends on preferred stock, $136,645; surplus for the year, $467,356. This, after payment of six per cent on the cumulative preferred stock, is equal to 7.7 per cent on the $6,000,000 common stock. The total surplus was $925,607, which, after deducting miscellaneous charges, makes a profit and loss surplus of $654,139.

THE MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA.

The Marconi Wireless Telegraph Company of America has issued a financial statement for the year ended January 31, 1908. This statement shows the following assets and liabilities: Assets—Patents, good will, etc., $5,491,885; stations and experimental work, $126,968; apparatus on hand, $16,853; accounts receivable, $17,946; cash, $1,757; treasury stock, $145,200; furniture and fixtures, $1,060; organization expenses, salaries, etc., $122,422. Liabilities—Capital stock, $6,044,800; Marconi Wireless Telegraph Company of London, $16,281; accounts payable, $8,763; notes payable, $9,600.

UNITED RAILWAYS AND ELECTRIC COMPANY.

The income account of the United Railways and Electric Company, of Baltimore, Md., for the year ended December 31, 1907, shows gross income of $7,018,-081; expenses, $3,470,087; other income, $6,505; total income, $3,554,499; charges, $2,487,942; other expenditures, $1,028,-899; balance, $37,658. This compares with a balance in 1906 of $291,298.

KANSAS CITY RAILWAY AND LIGHT COMPANY.

The report of the Kansas City Railway and Light Company for February and the nine months from June 1, 1907, to February 29, 1908, compares as follows: February gross, 1908, $464,118; expenses, $251,389; February net, $212,-729; taxes and interest, $151,050; February surplus, $61,679. Nine months' gross,

$4,639,176; expenses, $2,391,634; nine months' net, $2,247,542; taxes and interest, $1,379,071; nine months' surplus, $868,471.

PHILADELPHIA ELECTRIC COMPANY.

The report of the Philadelphia Electric Company for the year ended December 31, 1907, shows a gross income of $4,984,350; expenditures, taxes and charges, $4,075,001; surplus, $909,349; dividends, $499,935; surplus after dividends, $409,414; previous surplus, $1,732,520; total surplus, $2,141,934. The surplus is equal to 9.9 per cent on the $10,000,000 paid-in capital stock. The gross for 1906 was $4,503,876. The total expenditures for that year were $3,683,161, making $820,717 available for dividends, which amounted to the same as in 1907.

At the annual meeting of the Philadelphia Electric Company the directors and old officers were re-elected.

BROOKLYN RAPID TRANSIT COMPANY.

A statement has been issued by the Brooklyn Rapid Transit Company devoted to the earnings for the six months ended December 31, 1907. The total earnings from operation were $10,399,571. This is divided as follows: Passenger, $9,919,366; freight, mail and express, $191,251; advertising, $77,553; American Railway Traffic Company, $211,401. The total operating expenses were $5,940,726, divided as follows: Maintenance of way and structure, $527,807; maintenance of equipment, $945,104; operation of power plants, $843,703; operation of cars (trainmen's wages), $1,734,082; operation of cars (other expenses), $786,047; damages and legal expenses, $503,219; general expenses, $318,131; freight, mail and traffic expenses, $115,353; American Railway Traffic Company expenses, $167,280. Income from other sources—rent of land and buildings, $40,809; rent of track and structure, $48,794; miscellaneous, $268,961. Deductions—taxes, $464,902; interest and rentals, net, $2,788,597. Net income, $1,563,910. Special appropriations, $211,705. Surplus, $1,352,205, equal to three per cent on the $45,000,000 capital stock.

Cleveland (Ohio) Street Railway Settlement Delayed.

Contrary to expectations no decision was reached in the matter of the valuation of the Cleveland Electric Railway at the meeting with the city officials on Tuesday of last week. While all points in the matter of franchises and leases have been agreed to, negotiations have stuck over the valuation. The city's last offer is $50 a share for the railway company's stock; the company's price is $61.75. The prospect, apparently, is for a continuance of the contest unless concessions are made.

Capacity of Cables.

Specifications issued for the supply of high-tension cables usually contain a clause to be filled out by the offering company giving the value of the capacity the manufacturer is prepared to guarantee. In many cases this is an important factor in determining the size of the generating machines and may indeed be the factor deciding whether a proposed transmission line can be commercially successful. It is, therefore, frequently of primary importance to a cable manufacturer to guarantee as low a capacity for his cable as possible. In this article F. J. O. Howe discusses the various methods employed for measuring such capacities, shows wherein they are faulty and describes the method which he has found most satisfactory for every-day use. The general method of testing short cables is by comparing them with a condenser, charging first the cable and then the condenser, comparing the kick which each discharge imparts to a ballistic galvanometer. In this method the correctness of the results depends upon the relative value of the charging and leakage currents, and it is found by experience that the charge method gives results of sufficient commercial exactness in the case of rubber, gutta-percha and jute cables; but for paper cables the results are four or five times too high. This error does not suggest any difference between paper and rubber as a dielectric, but is simply due to the fact that in the case of paper-insulated cable the leakage current can have such a value compared with the true charging current as to make results obtained by the charging method of no practical value whatever. This error has been found to be a minimum in the case of paper and air-space telephone cable, for here, although the charging current is very small, the leakage current is also small. In the case of low-tension paper cable the error is still under five per cent, but for paper cable intended for 20,000 volts the error may be 100 per cent or more, as here the capacity is diminishing, while the insulation resistance either remains constant or even diminishes. This condition is due to a change in the impregnating compound, which must be more viscous to enable these heavy conductors to be bent. The author then gives a comparison of the results obtained when measuring the capacity of such a cable by the charge method and by the charging-current method, the latter being that test in which a high potential is applied to the cable and the charging current actually measured. The figures show a difference of 200 per cent, the charging-current method giving results fairly consistent but one-half or more less than those given by the charge method. The method which the author has devised was intended to have the following advantages: practical exactness, rapidity in testing, direct reading if possible, freedom from high-voltage dangers, economy of apparatus, and simplicity, in order that assistants without technical education might conduct the test. The method chosen as being the most suitable was that devised by De Sauty. This is a bridge method arranged for employing alternating currents in which the unknown capacity is balanced against one known, the other two arms of the bridge containing non-inductive resistances. The indicating instrument was a telephone receiver. An induction coil was first used for giving the high potential. This was later replaced by a generator giving frequencies of 125, 200 or 300 cycles per second. In neither case was absolute silence obtainable in the telephone, but a clear minimum was distinguishable. To increase the sharpness of the tone in the telephone a sine wave-form was obtained by means of resonance, this being accomplished by means of coils containing no iron, which could be slipped one over the other. This method gave results from two to five per cent lower than those obtained by the charging-current method, but the error here may have been due to a change in form of the electromotive-force wave. This method, while giving good results, did not seem to be as good for regular testing as the following: A bridge was arranged with a standard condenser in one arm, a variable resistance and a fixed resistance in two others, the cable to be tested being connected in the third. A secohmmeter, a galvanometer and a storage battery completed the equipment. This arrangement gives very reliable results even when the capacity under test differs considerably from the standard condenser.—*Electrician (London), March 20 and 27.*

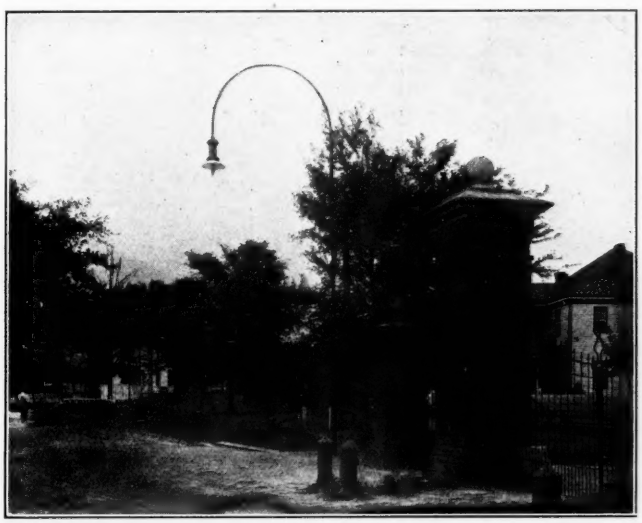
Michigan Electric Association.

The annual meeting of the Michigan Electric Association will be held in Grand Rapids, Mich., August 18, 19, 20 and 21. H. W. Hillman, Grand Rapids, is president, and A. C. Marshall, Port Huron, secretary of the association.

TEACHING THE ELECTRIC TRADE AT TUSKEGEE INSTITUTE, ALA.

BY D. A. SMITH.

Students entering the electrical division of Tuskegee Institute are anywhere from fifteen to thirty years of age, and generally they know nothing of the trade they are to study. A few of them have never heard an electric bell, seen an electric light or ridden in an electric street car. When they graduate from this division they can install an electric light or power plant of several hundred kilowatts' capacity, from erecting the generators and switchboards to building the lines and installing the wiring for the lights. I thought it might prove interesting to your readers to learn how this school takes these young colored men, in many cases crude and uninformed, and turns them out as practical electricians.



LIGHTING ON THE TUSKEGEE INSTITUTE GROUNDS, TUSKEGEE, ALA.

WIRING AND DISTRIBUTING TOWER, TUSKEGEE INSTITUTE GROUNDS, TUSKEGEE, ALA.

Most of these students work one day and go to school the next, in order to get enough academic training to carry on their trade work intelligently. In their first year they are taught the use and care of tools pertaining to their trade. These tools are kept in a large and well-arranged tool room on the second floor of the Boys' Trade Building, which houses most of the industries of the institute. They are further taught how to properly erect and guy poles, string wires, hang transformers, install lightning arresters—in fact, they must become familiar with everything pertaining to first-class line construction. The institute is spreading so rapidly that there are always new lines to construct or existing ones to change, so that the students have plenty of work of this kind to do. The Underwriters' rules are also studied very carefully the first year, and every day the students put their knowledge into practice by wiring new buildings or extending and changing work in the old. By means of lectures and class-room work they get a thorough course in the principles of electricity, and by means of simple experiments are made to see that theory and practice, particularly in electrical matters, are one and the same thing.

In the second year more advanced work in the theory of electricity is taken up, and many problems are given the students to work out which require the use of the arithmetic and algebra they have acquired in the academic building on their school days. The work on line construction and inside wiring is still kept up, bearing in mind that for a time at least this will be their chief employment when they leave school.

In the third year alternating-current work is touched upon, using the International Correspondence School textbooks for reference. The students also take laboratory work, and are required to become familiar with the use of the Wheatstone bridge, the slide-wire bridge, the Bunsen photometer, etc., and to perform various experiments suggested by the instructor. Every Wednesday night, from seven to eight o'clock, there is a lecture in this laboratory, when the students are either addressed by the instructor or by some engineer or scientific man in charge of actual construction work.

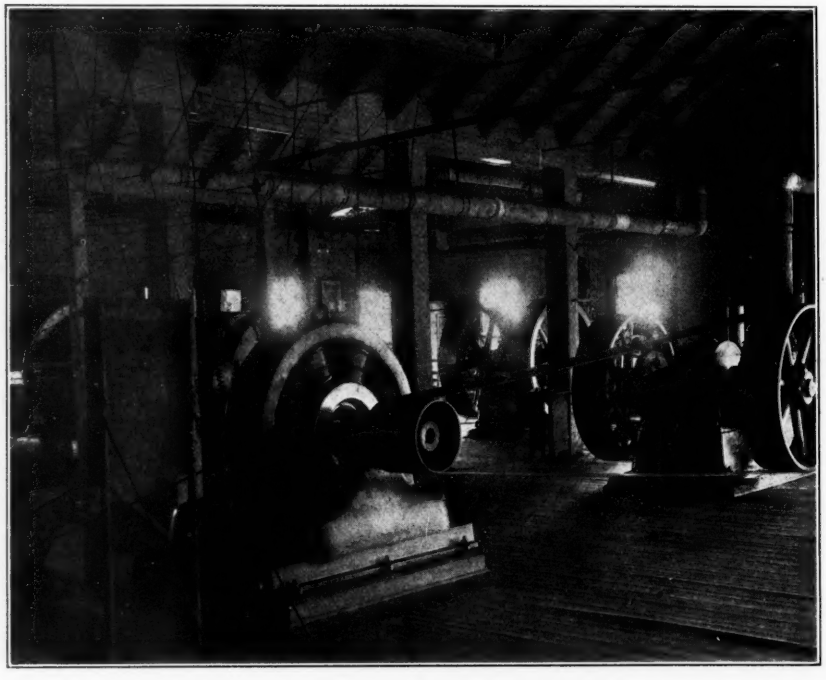
All during their course men are put on the "dynamo runs," as they are called, a first or second-year man acting as assistant to the third-year man who has charge of the plant for that night. The evening run lasts from dusk to twelve o'clock, and the morning run from three o'clock until daybreak.

The plant consists of two high-speed automatic engines, fourteen by fourteen inches and twelve by twelve inches, respectively. The smaller engine is belted directly to a fifty-kilowatt, 1,040-volt monocycle General Electric generator, and the larger engine to a 150-kilowatt generator of the same type. Steam is furnished at ninety pounds pressure by four horizontal return tubular boilers, situated in the boiler room, which is about 240 feet from the engine room. Each engine is supplied by its own steam main running in a separate brick conduit. The large engine is fitted with open and closed exhaust steam-feed water heaters, so arranged that either type of heater can be used at pleasure. The twelve-by-twelve-inch engine exhausts directly to the atmosphere, but this will also be fitted with feed-water heaters as soon as the piping is finished. This installation of the engines, boilers and piping was done by students in the mechanical division, and the installation of the generators, switchboard and wiring by students in the electrical division.

The first electric light plant of the institute consisted of an old 200-light Brush dynamo, driven from the sawmill engine. This machine was overloaded from the start, and the next year the fifty-kilowatt alternator was purchased. Overloading troubles were now transferred from the generator to the engine, making it necessary to purchase the fourteen-by-

fourteen-inch engine a few years later. As the load still further increased, the 150-kilowatt alternator was installed, and finally last year the twelve-by-twelve-inch engine was purchased to drive the old fifty-kilowatt machine, which had been enjoying a well-earned rest for three years.

The present connected load on the station is 5,000 sixteen-candle-power equivalents, and at the peak of the load the output is about 100 kilowatts. There is no doubt that the present plant will have to be enlarged again in the next year or so, probably by the installing of a 250-kilowatt, direct-connected unit, which will be able to carry the entire load. It is also the intention of the school to replace the six or seven small engines in the various shops by motors, thus saving the losses incident to the present long runs of steam piping. The new machine will probably be a three-phase alternator, and the motors will be of the induction type, working at 220 volts.



Power Plant, Tuskegee Institute, Tuskegee, Ala.

One of the hardest problems to solve in connection with this plant was the satisfactory lighting of the enormous campus with the limited amount of power available. Arc lamps for general illumination were out of the question, and series incandescents required the purchasing of special apparatus. The plan finally adopted was to make use of the small poles, spaced seventy feet apart, and to use 104-volt, eight, sixteen or thirty-two-candle-power lamps as the case required. Illustrations herewith show the actual appearance of these poles. From fifteen to twenty lamps are placed on one circuit, and are controlled by a fuse and switch in a weatherproof box on one of the poles. Current is taken directly from the nearest lighting mains running to the various buildings. In this way, by using only material which was on hand, a very satisfactory result has been obtained.

A shut-down of this plant would be almost a calamity, for aside from inconvenience involved, the 1,500 students on the grounds would be sure to get into trouble under such circumstances. It speaks well for those students who act as firemen, engineers and electricians, that during the last three years the aggregate of the total number of shut-downs due to breaks in the machinery would not reach four hours.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on April 21, for the following electrical material: Eighteen soldering irons, for delivery at Norfolk, Va.; twenty transformers, for delivery at Charleston, S. C.

Bids will be opened on May 5 for 800 pounds of insulating rubber tape and 1,200 pounds of insulating cotton tape, for delivery at Puget Sound, Wash.

BOOK REVIEWS.

"L'Usure Anormale des Turbines Hydrauliques." Julien Dalemont. Paris. L'Eclairage Electrique. 61 pages. Illustrated. 5½ by 9 inches. Price, 2½ francs.

This brochure discusses the results which have been obtained in the operation of hydraulic turbines under various conditions, dealing particularly with the wear caused when these conditions are abnormal.

"Cours d'Electricité H. Pellat. Paris. Gauthier-Villars. Paper. 286 pages. Illustrated. 6½ by 10 inches. Price, 10 francs.

This book constitutes the third volume of Professor Pellat's course in electricity, which he conducts at the University of Paris. It takes up the subjects of electrolysis, electrocapillarity, and the conduction of electricity through gases, treating at some length the newer ideas of ions and electrons.

"The Copper Handbook." Horace J. Stevens. Houghton, Mich. Cloth. 1,228 pages. 6¼ by 8¼ inches. Supplied by the Electrical Review for $5.

This is vol. vii of "The Copper Handbook," which has, since its inception, been considered more or less as a court of last resort for complete information regarding statistics connected with the copper industry. The present volume contains about 180,000 words of new matter. There are twenty-five chapters, an increase of nine, treating of copper under the headings of history, geology, chemistry, mineralogy, mining, milling, concentrating, hydrometallurgy, pyrometallurgy, electrometallurgy, alloys, brands, grades, uses, substitutes, terminology, geography, copper deposits, copper mines and statistics. The arrangement is logical and orderly and, coupled with a table of contents, index and an alphabetical arrangement of districts, countries, mines, minerals and a glossary, renders it possible to ascertain the required information with considerable ease.

"Engineering Index Annual." New York city. The Engineering Magazine. Cloth. 450 pages. 6¾ by 9½ inches. Supplied by the Electrical Review for $2.

The "Engineering Index Annual" for 1907 is a welcome addition to the annual for 1906 and the previous four volumes, which include references from 1884 up to and including 1905. As in the annual for 1906, the publisher has adhered to the classified system which is followed in the monthly parts that form a supplement to the *Engineering Magazine*. The annual form has the advantage both to consultants and publishers, in that it indexes current literature while it is still fresh and timely in point of practice, and makes the original articles procurable if

desired. There is an improvement in the editorial arrangement of the present volume, the classifications having been slightly modified and painstaking effort made to standardize catch words and bring all references to a single subject together. Cross-referencing has been introduced on a much larger scale than in the preceding volumes. The book is arranged under the eight classifications of civil engineering, electrical engineering, industrial economy, marine and naval engineering, mechanical engineering, mining and metallurgy, railway engineering, street and electric railways. These divisions are further subdivided according to the recognized special divisions of each field. After these two steps have been taken the miscellaneous literature is assorted into closely related sections, the final arrangement under each section being strictly alphabetical. References have been compiled from about 250 sources, which include technical and trade journals published in every quarter of the world, and journals and transactions of engineering and scientific societies. Where the same article has appeared in several publications the references are grouped as much as possible, or the arrangement indicates that article which has treated most comprehensively of the subject matter of greatest interest to the searcher in the specialized field it refers to. The Index is a very valuable book, and we would not be without it.

"Steam-Electric Power Plants." Frank Koester. New York. D. Van Nostrand Company. Cloth. 473 pages. 340 illustrations. 7¾ by 10¾ inches. Furnished by the ELECTRICAL REVIEW for $5.

A long-felt want has been met with the issue of this work, as it supplies the consulting, designing, contracting and operating engineers, as well as draftsmen, contractors and manufacturers with complete and comprehensive information as to the design, construction and operation of steam-electric power plants. The author of this volume is well known as a writer on the subject treated here, in the technical journals of this and other countries. Mr. Koester has an international reputation in the engineering profession, and the manner in which the whole subject has been treated by him, embracing the entire field, from coal pile to bus-bars, is fully up to his high standard. In the brief preface it is noted that the plants designed, constructed and operated by him range in rating from 100 to 60,000 kilowatts. The body of the book is divided into eleven chapters, together with a table of contents, a list of illustrations, a list of tables and a well-arranged index. An appendix contains a number of useful physical tables. Each chapter has been subdivided; for instance, Chapter III, consisting of subdivisions, "Excavation and Foundations," "Building," "Structural Steel" and "Architectural Features," each item of the subdivisions being designated by the use of bold-face type, thus facilitating the finding of any desired topic.

The subject is treated in the following order: Chapter I, practical problems, efficiency and cost of plants, giving data on the preparation of plans and specifications, so as to minimize the first cost as well as the cost of operation. Chapter II treats of the location and general layout of plants, coal storage and condenser water supply. Many original drawings pertaining to American and European practice are presented here. The contents of Chapter III have been referred to above, but particular attention is called to the section on architectural features, with its many excellent illustrations of plants of European design, from which it is evident that these foreign designers have done much that may be commended in this direction, though in some instances, as pointed out by the author, American designers are not far behind. Chapter IV covers boilers, mechanical stokers and grates, coal, combustion, draft, smoke flues, chimneys, boiler feed-water, feed-water heaters, superheaters and superheated steam, and contains much practical, as well as theoretical, information, particularly for the designing, constructing and operating engineer, some eighteen pages being devoted to superheat and superheaters, a subject of much importance in modern power plant practice. Chapter V handles high and low-pressure piping systems, particular attention having been paid to this subject owing to the important relations it bears to the successful operation of the plant. Forty-three pages of the book have been devoted to it. High-pressure piping has been taken up in the following order, *viz.:* General consideration, size of pipes, systems of piping, expansion, anchors, supports, hangers, fittings, flanges, valves, drip system, pipe covering, boiler-feed piping and blow-off piping. Stress has been laid upon the advantages of using welded steel fittings, which, the author says, have been in use in Europe for a number of years, and are now being introduced in American practice. Chapter VI treats of reciprocating engines, turbines, condensers, pumping machinery and oiling systems, all of which are thoroughly handled in the fifty-two pages devoted thereto. As stated by the author in the preface, the book does not go into the details of design of apparatus, but gives all the information necessary to assist the station designer in the selection of makes, looking to the economical operation of the plant as well as to first cost. Chapter VII, on electrical equipment, we are obliged to state, should have been treated more fully. However, as explained by the author, since this branch is becoming more and more specialized, only such information is given on the subject as will properly guide the designing engineer in the layout of the plant. A number of illustrations of typical European and American switchboards and wiring diagrams accompany this chapter.

As the greater number of the power plants discussed in the technical press are of large size, the book in Chapter VIII discusses the design and construction of small-power plants. This topic was originally treated by the author in a series of articles which appeared in the ELECTRICAL REVIEW. Chapter IX covers the testing of plants, while Chapter X describes and criticizes the design and construction of five noted American and European plants, *viz.:* St. Denis Plant, Paris; Fifty-ninth Street Plant, New York; Chelsea Plant, London; Fisk Street Plant, Chicago, and Twin Municipal Plant, Vienna. These plants were chosen as each has individual features upon which special stress has been laid. This chapter is concise but replete with data. It gives the principal dimensions of the station and is profusely illustrated with drawings and half-tones, several of the former being double-page inserts. Chapter XI contains tables of principal dimensions and data of plants of from 4,000 to 60,000 kilowatts rating, with sizes of individual prime movers varying from 2,000 to 5,000 kilowatts. Between these tables are found sets of illustrations of nine large and small power plants, there being twenty-three line drawings and fifteen half-tones. The appendix of eleven pages contains physical useful tables, for the greater part in both the English and metric systems.

The book as a whole represents a lot of diligent work, much research and investigation, and is of inestimable value and is recommended to all who are interested in the subject.

ARTIFICIAL LOAD FOR TESTING ELECTRICAL GENERATORS.[1]

BY R. K. MORCOM AND D. K. MORRIS.

The question of artificial load is one which is often under consideration by manufacturers and electrical station engineers, and simple though the problem is, there seems to be little information of a practical nature to enable the designer of such plant to avoid the errors of his predecessors.

Of all methods of obtaining a load for testing purposes probably the water re-

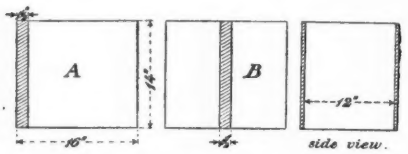


FIG. 1.—EXPERIMENTS SHOWING EFFECT OF PROXIMITY OF SIDES ON RESISTANCE BETWEEN TWO NARROW PLATES ONE-HALF-INCH WIDE.

sistance has been most used, and the first portion of this paper will treat of the use of water resistances.

The quality of water to be used is, of course, the first consideration. It is necessary to find its specific conductivity. A knowledge of the chemical properties of the water is a useful guide to its conducting properties.

It is also necessary to know the correction for temperature. The resistance-temperature curve is not a straight line. For practical purposes it is useful to consider the correction as a percentage re-

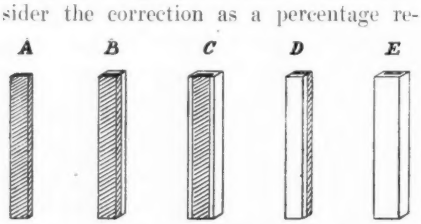


FIG. 2.—EXPERIMENTS SHOWING EFFECTS OF SHIELDING.

duction from the resistance at sixty degrees Fahrenheit for the intended rise of temperature, say seventy degrees Fahrenheit.

Without any special treatment of the problem of current flow in the water, it is useful to make one or two simple deductions from the general case. First, a very large body of water can not give a high resistance even when the electrodes are very far apart. Secondly, if the tank be long in proportion to its cross-sectional dimensions the extent of the electrode immersion makes very little difference to the resistance, provided that the area of the electrode is not very small compared with the cross-sectional dimensions of the water. If, however, the distance between the plates be small then their area of opposition has a great influence on the resistance.

In this connection it should be noted that proximity to the side of the tank has a great effect with narrow plates in large tanks, as illustrated by the following experiment (see Fig. 1):

The resistance in position A is fifty per cent greater than in position B. This is due to distortion of the lines of flow. Part of the distortion is equivalent to shielding the back and sides of the plate, an effect illustrated by the following experiment (see Fig. 2). Assuming the current with plates as at A to be equal to 100, the current in case B is equal to ninety-five, in case C to eighty-one, in case D to seventy-six, and in case E to fifty-seven (Fig. 1). This effect gives one means of varying the load. The position of the plates for this experiment was that marked B in Fig. 1.

Another convenient method of reducing the load from a given tank is by dropping diaphragms between the plates. As an example the following experiment (see Fig. 3) shows the effect in a particular case. Current as at A being 100, current as at B is only 26.5.

It is found that where the line of flow from the electrode along the tank-side differs but little in length from the shortest line, the voltage drop per foot should not exceed 600 volts, and should be lower than that unless the walls are well insulated and free from metal. This point must be watched with high-tension work, and also in low-tension work where plates that are close together are carried near the side of the tank. A further limiting condition indicated by experience is the maximum permissible current density per square inch of an iron electrode. It will be found advisable not to run at greater densities than one ampere per square inch. Trouble from bubbling and rapid corrosion is likely to occur if this be exceeded.

The success of wooden tanks depends largely on the method of construction and the proper attention to details. The following is the description of a tank (Fig. 4) which has done excellent service:

The dimensions are seven feet by one foot six inches by one foot, and it is used for high-tension work. The sides and bottom are constructed of good spruce, tongued and grooved; all joints are tarred and calked. Sides, ends and bottom are made double of one and one-half-inch timber, the two layers being built up at right angles, as shown in the sketch. The whole is screwed together in such a way that no screw comes within three-quarters of an inch of the water, and all timber is tarred all over.

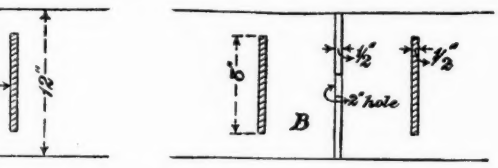


FIG. 3.—EXPERIMENTS SHOWING THE EFFECT OF DIAPHRAGM.

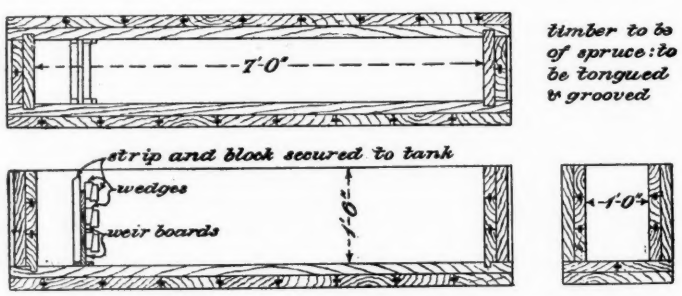


FIG. 4.—CONSTRUCTION OF WOODEN TANK FOR WATER LOAD.

The water inlet is through a canvas hose brought over at the outlet end and carried along the bottom of the tank for its full length.

The outlet is over a sectional wire six inches from the end of the tank and then through a hole in the bottom of the tank. One trouble thus avoided is the charring of the wood, which usually occurs along seams to which water has access; proper calking prevents this. Also, any metal in the wood to which water has access corrodes and causes charring. This is prevented by using hidden screws, a hose-pipe inlet, and a plain hole outlet. The hose-pipe inlet obviates troublesome short-circuits to earth, and the weir also pro-

[1] Paper read before the Birmingham, England, section of the Institution of Electrical Engineers.

vides for adjustment of water level. The double sides prevent leaking and undue bulging.

For tanks of larger dimensions iron stays may be used, but these should be carried outside the tank, an obvious but often neglected precaution.

As this tank is for high-voltage work it is supported on insulating pedestals.

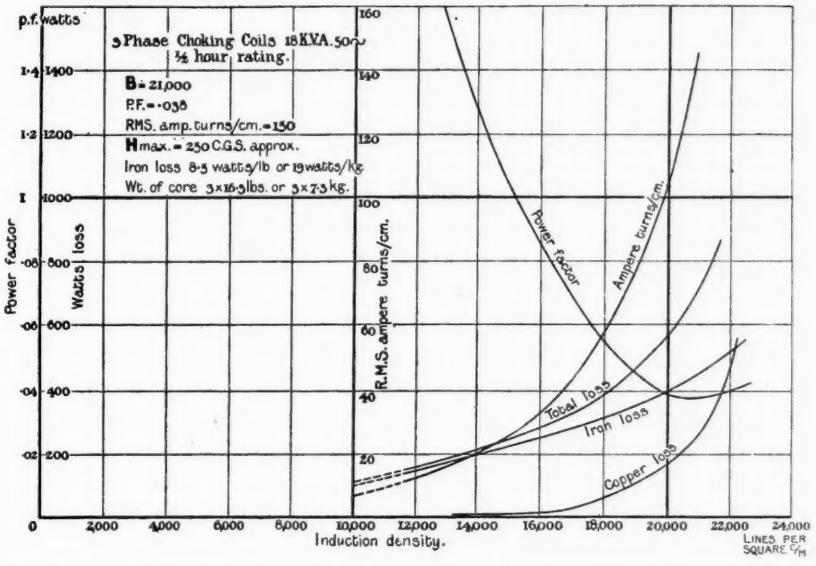


FIG. 5.—CHARACTERISTICS OF THREE-PHASE, EIGHTEEN KILOVOLT-AMPERE CHOKING-COIL AT FIFTY CYCLES.

These can conveniently be constructed of Doulton's glazed earthenware "acid tiles," built about three feet high, with a rubber pad between each horizontal face to prevent slipping.

The water from the outlet hole is carried to a funnel or tray just above the floor level. A lead-lined save-all is provided.

The operator has a wooden platform supported on earthenware blocks, and covered by a rubber mat.

The electrodes are of iron, and are well insulated from their supports, which take the form of stout wooden cross-bars which can be slid along the tank top. The plates are clipped to bus-bars carried at a considerable height, and the connections are so guided as to be neat and safe. Such an arrangement can be cheaply made, and gives satisfaction up to 6,000 volts.

A low-voltage tank construction can easily be deduced from the above, but probably the area will have to be obtained by using a number of electrodes in parallel, in which case, for variable loads, a suitably arranged switchboard is a great convenience. There are many ways of arranging the plates satisfactorily, but so much depends upon the type of testing for which they are constructed that a description of any particular arrangement will be of but little service. One point, however, should not be forgotten with iron electrodes, namely, that if they are placed less than two inches apart there is danger of an unsteady load, and a considerable splutter from short-circuiting by rust flakes; in fact, three inches should be aimed at as a minimum. Sometimes, for very low-voltage work the size of the tank available is insufficient. A useful form of load can then be constructed from metal strip submerged in water.

Strip-iron one-half inch wide by nineteen standard wire gauge supplied in forty-foot lengths and doubled into zigzag

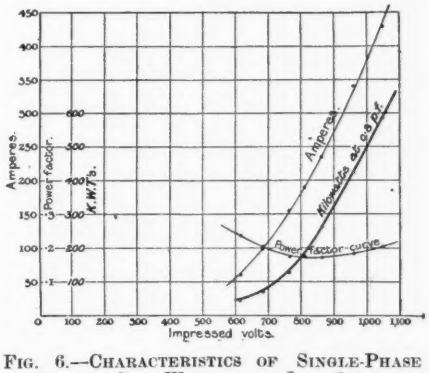


FIG. 6.—CHARACTERISTICS OF SINGLE-PHASE CHOKING-COIL WOUND WITH IRON STRIP.

shape will make very convenient units for low-voltage loads.

With a current density of about 25,000 amperes per square inch (the unit being immersed in moderately high-resistance water) an average life of 100 hours may be expected. If, however, the cooling water is of relatively low resistance, such as canal or river water, the life is very much reduced. In actual use a unit of this form has been run at a current density in the iron winding of 52,000 amperes per square inch in canal water of a specific resistance of 440 ohms per cubic centimetre at sixty degrees Fahrenheit, and broke down after an eight hours' run. Under these conditions the rapid wasting of the strip caused a gradually falling load. It is very convenient, when using these units, to have a small water load in parallel for fine adjustments.

Obviously the relatively short life and lack of facility of adjustment are the chief disadvantages of this form of load.

The convenience of the water resistance for absorbing a test load can be enhanced by providing a suitable apparatus for producing inductive load. Transformers and inductive motors are, of course, ideal, but in their absence choking-coils of cumbersome and expensive design have been constructed, usually as and when required. A cheap, reliable and easily adjustable method of obtaining varying power-factors under varying conditions is a desideratum.

Energy Loss in the Iron—On account of the high flux density it is important, in order to avoid eddy currents, to use the thinnest laminations and to reduce hysteresis by employing the best iron. As is well known, heavy iron cores can not be worked at fifty cycles for long at flux densities exceeding, say, 8,000, without very special means being taken for cooling them, and at the flux densities which are being used in these new coils described in the paper, such cooling is an essential condition.

Two methods, beyond those ordinarily used for transformers, suggest themselves for working such high flux density choking-coils continuously without overheating.

1. The whole coil and winding may be immersed in water kept in circulation and slowly flowing to waste.

2. The limbs of the iron core may be surrounded by coils of flat copper tube, closely fitting, in which water is continually flowing and absorbing any heat which might otherwise reach the winding from the hot core; such coils being coupled by rubber pipes to supply and discharge, so that no current shall be induced in them.

For voltages much higher than these, or where a more durable apparatus is necessary, it is preferable to use water-cooled cores of the type described above.

Comparison Between a Transformer and a Choking-Coil Wound on the Same Core and Worked at the Same Flux Current Densities—Consider a low-voltage, ten-

kilowatt transformer of standard design. Its "magnetizing" current, by which is meant the out-of-phase component of its no-load current of, say, one per cent, is such that at the peak of the waves there is a field of, say, H = 1, giving a maximum flux density of, say, B = 5,500. Now replace the primary and secondary windings by a single winding of double the carrying capacity, and increase the primary terminal pressure to four times its former amount. The single winding must now take current enough to make B = 22,000, which requires, say, H = 200, so that the current taken is two hundred times as great as the old magnetizing current, and twice as great as the normal full-load current of the old transformer.

This current passes through a winding of twice the old carrying capacity. With the current doubled and the voltage quadrupled, the kilovolt-amperes of the apparatus now are eight times as great as those for which the transformer was built or eighty kilovolt-amperes, and this with the same current densities as before.

To test a 1,000-kilowatt set at 0.8 power-factor requires approximately 1,250 kilovolt-amperes, and 750 kilovolt-amperes of idle current, or three 250-kilovolt-ampere choking-coils. With the special cooling described above, these inductive coils can be constructed on cores not exceeding in size those which would be used for three twenty-five-kilowatt transformers.

Power-Factor—Referring again to the example of a ten-kilowatt transformer, the copper loss in the windings might be three and one-half per cent, or 350 watts. At these high flux densities the core loss may be as much as 1,100 watts. Thus the total loss is 1,450 watts, and the power-factor of the current taken is accordingly 1.45/80 = 0.018. This is an exceedingly low power-factor, and corresponds to the lowest that can be obtained with a choking-coil of the ordinary construction, even when very liberally designed. It represents a lag of nearly eighty-nine degrees. The lower the power-factor the less the energy which has to be got rid of in the inductive coils, and consequently the higher the figure at which such coils may be rated.

The manner in which power-factor varies with the voltage or flux density is clearly shown in the curves (Figs. 5 and 6). The data given in Fig. 5 relate to the condition of working which gives the least power-factor. Curves showing the various losses are also given.

Characteristic of Closed-Core Choking-Coils—The relation between impressed terminal voltage and current (root-mean-square) taken by the coils depends upon the magnetization curve of the iron used in the core, as well as on the wave-form of the current itself. At high flux densities a relatively small drop in voltage reduces the current almost to nothing. It is characteristic, therefore, of these choking-coils, that while they work well over a wide range of current, yet their range of voltage is small.

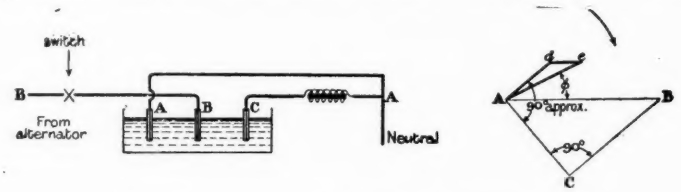


FIG. 7.—COMBINED WATER LOAD AND INDUCTIVE LOAD.

A B = Total voltage to neutral.
A C = Voltage across choking-coil.
B C = Voltage across series resistance.
A d = Current in choking-coil and series resistance.
d e = Current in shunt resistance.
A e = Total current.

Regulation of Voltage and Current—It is not practicable to have special inductive loads made for every voltage and current of the machines which may have to be tested. It is, therefore, of the greatest importance to provide means whereby the voltage as well as the current of an inductive load may be regulated while the power-factor is maintained at a specified value of, say, 0.8.

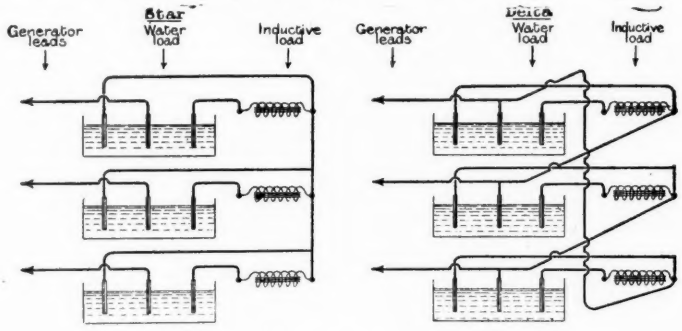


FIG. 8.—CONNECTIONS FOR THREE-PHASE WORKING.

The most satisfactory method of arranging for such regulation is by means of water resistance arranged in such a manner that the inductive coil current is

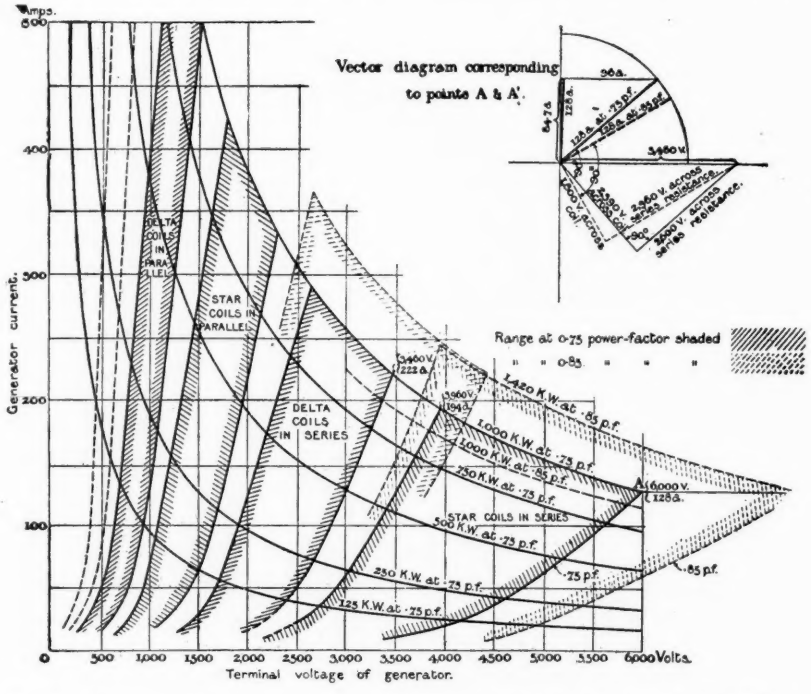
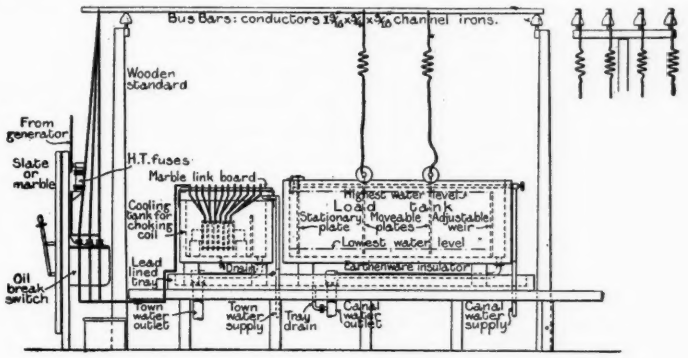
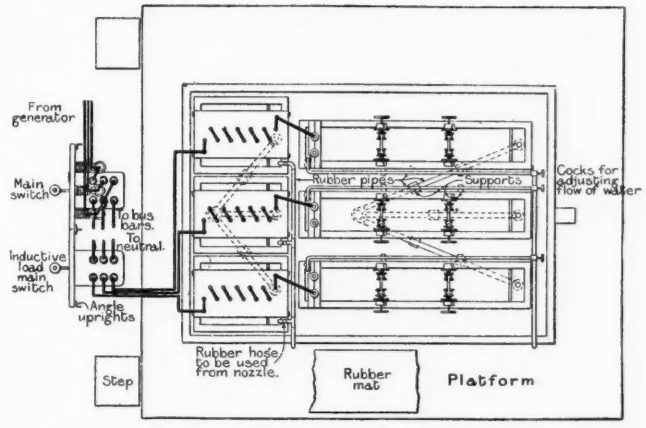


FIG. 9.—RANGE OF VOLTAGE AND CURRENT WITH GIVEN THREE-PHASE CHOKING-COILS.

shunted by an in-phase component of current in a water load, while, at the same time, resistance may be put in series with the choking-coil (see Fig. 7).





FIGS. 10 AND 11.—SUGGESTED DESIGN FOR ARTIFICIAL LOAD. INDUCTIVE AND NON-INDUCTIVE SUITABLE FOR 1,000 KILOWATTS AT 1,000 TO 6,000 VOLTS. ALSO AT 500 VOLTS WITH HEAVIER SWITCHGEAR AND LOADS WITH EXTRA PLATES FOR WATER LOAD.

By shifting the plate B toward A or C, the double adjustment may be conveniently effected at one time. Adjustment is also obtained by raising or lowering one or more of the plates. The inductive coil may be either immersed in the tank, or may be in a separate place, according to the method used.

Further variations of voltage and current may be obtained by the well-known method of paralleling the coils, or changing from star to mesh connection, or both, used always in conjunction with the above combination of water loads (Fig. 8).

Since the change from star to mesh coupling reduces the voltage for which the inductive set is suitable and increases the current by $\sqrt{3}$, it is convenient to make the next step down in voltage correspond to the paralleling of three equal sections of the winding, since this will again give a step $= \sqrt{3}$. The next step, again, would then be by changing from star to mesh, the coils remaining still in parallel.

In this way an extreme range of voltage of as much as 9 : 1 may be obtained with a three-phase set, each of whose windings is subdivided into three parts only, while throughout this range the set can be worked, if required, at constant kilovolt-amperes and core flux density. For testing at reduced loads the correspondingly smaller kilovolt-amperes are obtained by working the cores slightly at lower flux density.

For economy in design it is best to use choking-coils wound for the lowest voltage

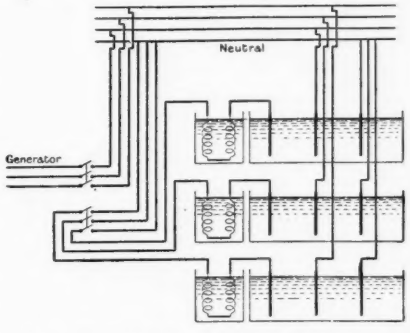


FIG. 12.—DIAGRAM OF CONNECTIONS ON FIGS. 10 AND 11.

which will satisfy the purpose for which the coils are required. If they are wanted for testing three-phase generators at a moderate power-factor, it will be found that the necessary coil-voltage is not more than one-third to one-half of the terminal voltage of the machine under test.

For example, let it be required (see Fig. 9) to test a generator of 1,000 kilowatts at 6,000 volts and fifty cycles; the test to be carried out at 0.75 power-factor. Using Y-connections, this means in each branch a voltage of 3,460 and a current of 128 amperes, being the resultant of an in-phase current of ninety-six amperes and an out-of-phase current of 84.7 amperes. Each branch of the circuit requires therefore a choking-coil designed for 84.7 amperes and 3,460 volts, shunted by a water resistance taking ninety-six amperes at the same voltage. No water resistance whatever would be used in series with the coils.

It is possible, however, to obtain the same result using choking-coils wound for lower voltage and correspondingly higher current. The coils can each be wound for the full current, 128 amperes, and resistance can be arranged in series only with the coils. If the coils are so designed that, when taking this current, the voltage across each coil is 2,290 volts, while the drop across each water resistance in series with a coil is 2,600, then, since these two voltages are practically in quadrature, the full phase-voltage of 3,460 volts will be maintained as before and the current will be 128 amperes, at 0.75 power-factor also as before.

Thus, to carry out a 0.75 power-factor test on a 1,000-kilowatt, 6,000-volt generator requires three coils each for 128 amperes at 2,290 volts only; while the combined kilovolt-amperes of the coils is $3 \times 128 \times 2{,}290$, or 880 kilovolt-amperes as compared with the 1,333 kilovolt-amperes of the generator. Similarly, if the test had been required at 0.85 power-factor the coil-voltage would have been 1,820 volts, and the combined kilovolt-amperes of the coils 620, the generator kilovolt-amperes being now 1,130.

Generally, if

E_g = terminal volts of three-phase generator,

W = output in kilowatts, and

Cos ϕ = required power-factor during test;

then the three choking-coils needed should be wound each for a current of

$$I = \frac{W}{(\sqrt{3} \cdot E_g \cdot \cos \phi)},$$ and a voltage of

$$E_c = \frac{E_g \cdot \sin \phi}{\sqrt{3}}$$

The maximum combined kilovolt-amperes of the three coils is, therefore, $= W \tan \phi$.

It will be plain from the above that the combination of inductive coils and water resistances described in the paper is capable of dealing with a given number of

kilowatts at a specified power-factor over a range of voltage extending from $E_g \sqrt{3}$ down to sin ϕ times this amount, where cos ϕ is the power-factor. The range of current is correspondingly as sin ϕ : 1.

Throughout this range both voltage and current of each choking-coil is that for which they have been assumed to have been designed. When the coil-voltage is reduced the current will fall off rapidly after the manner shown in Figs. 5 and 6. By using similar arguments to those given already, it is seen that a combined inductive and water-load as described can deal with a range of voltage, current and power as well as a given power-factor. Such a range is shown by the shaded area on the right-hand side of the figure (Fig. 9) worked out for 0.75 power-factor and 1,000 kilowatts or less.

To extend the range of the set the sections of the combined load may be coupled in mesh or delta connection. In this way the current capacity is increased as 1 : $\sqrt{3}$, while the voltage limits are correspondingly reduced. On referring again to Fig. 9, it will be noticed that this covers another large range of voltage, current and power which will overlap the former range only when sin ϕ is equal to or less than $1/\sqrt{3}$, or 0.578, which means that the power-factor of the test must not be less than 0.816. Above this power-factor the ranges covered overlap; below it there are certain currents and voltages which can not be dealt with.

To deal with yet lower voltages and higher currents, it is convenient to subdivide the windings on the coils each into three sections as described above. These, when paralleled and star-coupled, give a set of volt-ranges one-third of those first available, and consequently reduced as $\sqrt{3}$: 1 from the second arrangement in which the apparatus was delta-connected and all the windings on each core were in series.

Lower voltages still can, of course, be obtained by delta-coupling the third arrangement; and, if advisable, by further subdivision of the coils into nine sections each.

In each of the arrangements the range of power which can be dealt with at a given power-factor is the same—namely, 1,000 kilowatts and less for tests at 0.75 power-factor, and from 1,420 kilowatts and less for tests at 0.85 power-factor.

The combination of coils and water-loads described here is thus of a very flexible nature and well suited to deal with the variety of generators which may have to be tested commercially.

The kilovolt-amperes of an inductive load being fixed, the winding must be so chosen that the following conditions are satisfied: (*a*) It must carry the required current without undue heating continuously, or, in special cases, for a given short period; (*b*) its number of turns must be such that, when carrying this current, a back electromotive force equal to the required terminal voltage is obtained, and (*c*) there must at the same time be enough ampere-turns operating on the coil's magnetic circuit that the requisite high flux density is obtained. If the coil is above a very small size, and not required for short-time rating only, the core must be cooled.

The use of these coils worked at such high flux densities gives rise to a current-wave whose peak is about ten per cent higher than that of an equivalent sine-wave of current. That is, in calculating the ampere-turns available for producing the maximum of flux density the root-mean-square ampere-turns must be multiplied by about 1.56; so that the value of H is about 1.96 times the root-mean-square ampere-turns. The approximate field is therefore roughly obtained by doubling the root-mean-square ampere-turns. The distortion of wave-form is, however, not very great owing to the very high flux density, and therefore uniformly low permeability which occurs.

Approximate data relating to Sankey's Lohys and Stalloy irons at these high flux densities, based partly on the author's experiments, are given below:

B.	H.		Loss per Pound at 50 Periods.	
Lines per Sq. Cm.	Lohys. C.G.S. Units.	Stalloy. C.G.S. Units.	Lohys. Watts.	Stalloy. Watts.
18,000	100	132	5	4.0
20,000	220	275	8	7.5
22,000	360	440	11	10.0
24,000	500	600	14	12.5

The most suitable design of choking-coil is in many cases that giving the least power-factor. This factor is the ratio of copper and iron losses to the total kilovolt-amperes of the choking-coil. The losses depend on the square of the current and on some similar function of a not widely varying flux density, while the kilovolt-amperes are proportional to current and flux density. Thus there will be a point at which the power-factor is a minimum which occurs at a higher flux density the larger the coil. This is illustrated in the curves already given in Figs. 5 and 6.

It is difficult to generalize as to the best method of combining the details, but the authors append a suggestion for a working plant on lines which have been found very satisfactory in practice over a large range of conditions (see Figs. 10 and 11). The diagram of connections for this arrangement is given in Fig. 12. The inductive coils here shown are cooled by immersion in suitable tanks in which water is circulated, as also in the main load tanks by a system of pipes clearly indicated.

Curtis Turbine Business.

A recapitulation of the Curtis turbine business executed by the General Electric Company, Schenectady, N. Y., forms one of the most interesting indications of the development of this important type of prime mover, and is an evidence of the remarkable popularity which it has achieved, although of comparatively recent adaptation. Orders to December 31, 1907, for central station and railway plants showed a total kilowatt capacity of 986,020. This capacity was distributed among 261 plants, with an average kilowatt capacity of 3,778. Of the 261 plants, seventy-one were of 1,000 kilowatts capacity or less, and 190 had a greater capacity than 1,000 kilowatts. There was a total capacity of 87,675 kilowatts distributed among 288 plants, with an average capacity of 305 kilowatts. Two hundred and forty-three of these plants had 1,000 kilowatts or less capacity, and forty-five more than 1,000 kilowatts capacity. The total number of plants was, therefore, 549, with a total capacity of 1,073,695 kilowatts. The installations to December 31, 1907, totaled 943 machines. Orders on that date totaled 153, making the total sales 1,096.

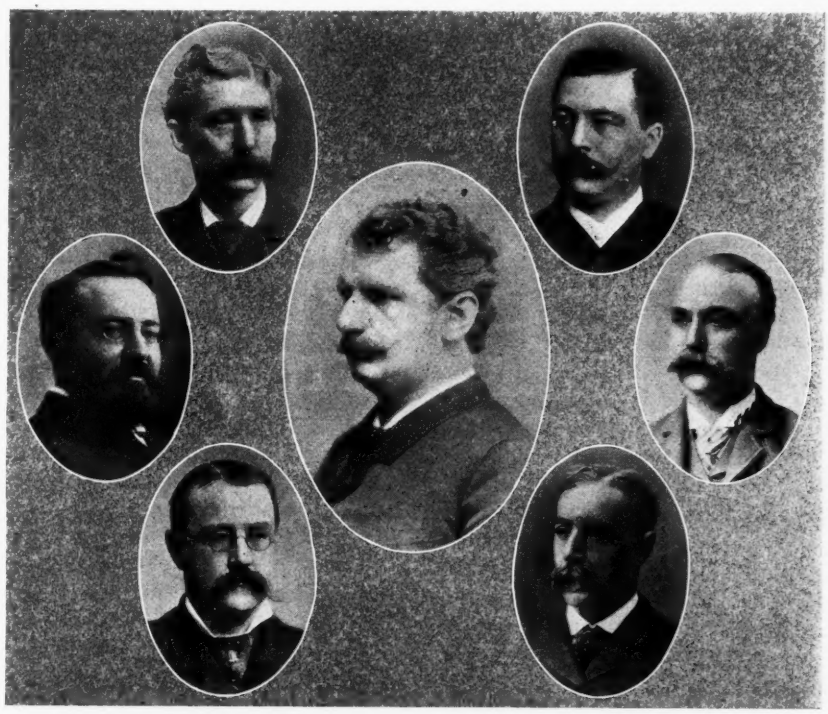
The most noticeable single item is the total capacity sold to December 31, 1907. This amounts to about 1,556,000 brake-horse-power, and is the strongest indication of the advance of the steam-turbine generating unit that has ever been published. That this advance is accelerating rapidly is shown by the amount of sales of Curtis turbine generators for the fiscal year ended February 1, 1907, of the General Electric Company. This amounted to a capacity of 286,320 kilowatts (325 machines, average capacity, 890 kilowatts), or more than twenty-five per cent of the total sales since the Curtis turbine was introduced.

Another indication of considerable interest is the large number of plants for which this turbine has been selected. The extensive range in sizes is probably responsible for the great variation in the average sizes of the plants in which it has been installed. A striking difference is shown in the average size of 3,778 kilowatts in the central station and electric traction enterprises, and the 305-kilowatt size in industrial plants.

Early Telephone Officials.

A group of pioneer telephone men is presented on this page. To all who are familiar with the development of this invention, one of the half-dozen truly great inventions in the history of the world, the names and photographs of the gentlemen here presented will recall the very enthusiastic and intelligent work that was begun in 1880 to establish the use of the telephone in all parts of the United States. Its possibilities were at that period an unknown quantity.

It is probably due to Theodore N. Vail, the first general manager of the American Bell Telephone Company, of Boston, more than to any other individual, that the telephone service of the country was placed on a developing basis of such importance and advantage to the public from the very beginning. The picture shows Mr. Vail and his staff, consisting of O. E. Madden, assistant general manager, and Special Agents Robert S. Boyd, Charles R. Truex, J. M. Brown, Thomas B. Doolittle and Frank B. Knight as they appeared in January, 1882. These five special agents were the original agents, and their territory covered the entire United States, Mr. Vail as general manager, and Mr. Madden as assistant general manager, making their headquarters in Boston.



A Group of Early Telephone Officials of the American Bell Telephone Company.

Thomas B. Doolittle. O. E. Madden. Robert S. Boyd. Theodore N. Vail. Frank B. Knight. Charles R. Truex. J. M. Brown.

After a lapse of twenty-six years since this group of photographs was taken, all the living members still remain in the telephone business. Mr. Vail, after a cessation of several years of active telephone work, although always possessed of a large interest in the parent company, has within the past year again assumed the helm and is now the president of the American Telephone and Telegraph Company, the parent Bell telephone organization, and Messrs. Truex, Brown, Doolittle and Knight are also actively engaged in the telephone business of the same company or its licensees.

Mr. Vail makes his headquarters in New York city, where also is located Mr. Truex, while Major Brown is located at Washington, D. C.; Mr. Doolittle in Boston, and Mr. Knight in Dallas, Tex.; Major Brown and Mr. Doolittle having been constantly with the Bell interests since its first organization, Mr. Knight and Mr. Truex returning to the fold after short intervals of work in other lines.

Swiss Telegraphs and Telephones.

In stating that the Swiss Government owns and operates all the telegraph and telephone lines in the confederation, Consul R. E. Mansfield, of Lucerne, furnishes the following details as to their management:

"The telegraph and telephone service extends to nearly every town and village in the country, and every railway station is supplied with both systems. The service is good and the rates low. They are operated in connection with the postal service, every post-office being provided with telegraphic facilities, and practically all of them with public telephones.

"Distances in Switzerland being short, the service prompt and the rates low, the telegraph and telephones are liberally patronized. Long-distance connections are made with all the local or urban telephone lines, enabling patrons to communicate with all cities and towns in the country. There are also international connections with all the countries bordering on Swiss territory.

"A feature of the Swiss telephone service is that in addition to owning and operating all the lines, the government manufactures all the instruments used, makes the insulations and controls the business absolutely.

"The total length of telephone lines in Switzerland is 10,548 miles. The annual rental charge for offices, business houses and residences is $12.45 per year. An additional charge of one cent is made for each call in the town. For interurban or long-distance calls the rate is two to fourteen cents for three minutes, according to distance, fourteen cents being the maximum rate for any distance in the country.

"The number of telephone subscribers in 1906 was 53,711. During the year there were 32,071,177 local, 7,251,193 interurban and 299,209 international calls over the government telephones. The revenue from all classes of calls for 1906 was $829,732; income from rent on 53,711 telephones, $668,702. Total, $1,498,434.

"The total length of telegraph lines in Switzerland is 66,683 miles. The total number of telegrams transmitted in 1906 was 4,918,679, of which 2,339,956 were international and 1,698,838 local. The total revenue from telegrams for the year was $1,596,664.

"There is a government tax of thirty centimes, equal to a fraction under six cents American money, on each telegram sent. In addition to this charge there is a universal rate of one-half cent a word throughout the country, distance not being taken into consideration.

"The total income from telephone and telegraph service for 1906 was $3,095,098; expense, $2,231,217; profit to the government, $863,881.

The Illuminating Engineering Society.

The regular meeting of the New York section of the Illuminating Engineering Society was held on Thursday evening, April 9, at the Engineering Societies Building. Dr. Clayton H. Sharp, past-president of the society, addressed the meeting on "New Types of Electric Lamps."

Dr. Sharp spoke extemporaneously and took up in turn the characteristics of the various filaments and the methods of production which enter into the several classifications of incandescent lamps. He described first the method of making the metallized carbon filament, and then indicated the first great step in advance of the metal filaments over the carbon filaments in the production of the metallic osmium filament by Dr. Auer von Welsbach. This osmium filament lamp was made commercially and had been applied with great success, operating on fifty-five volts, two or four lamps in series, on the regular lighting and power circuits, in England, in Germany and Austria, and in other countries on the Continent. The fundamental obstacle to the wide use of metallic osmium filament lamps is the small supply available. Osmium is secured as a by-product in the reclamation of platinum. The visible supply of raw material, Dr. Sharp stated, is not great enough to provide filaments for the lamp demand which such a company as the New York Edison Company would have to meet for its ordinary renewals.

Passing to the tungsten lamp, Dr. Sharp first described the experiments of Kusel with colloidal solutions, the Just and Hahnaman substitution process, and the Zee process, which utilized as a binder for the tungsten particles an explosive which at the combining heats was assumed to consume itself. Several other processes, some of which are in use at the present day, in both foreign and United States manufactories, were described very briefly.

In point of time of commercial application, the tantalum lamp followed after the osmium lamp and was really the available predecessor of the tungsten lamp. The tantalum filament had many properties which rendered it admirable for lamp making, in that it was ductile, could stand a high degree of heat, had a positive temperature coefficient, withstood voltage fluctuations readily, and gave a good quality of light.

The tungsten lamp, even at this early day, was meeting with great popularity, and was showing some remarkable results under very severe tests. The tungsten filament has a positive temperature coefficient and can be easily rated at a commercial efficiency of 1.25. What was probably a very important element in the utilization of tungsten lamps was the stability of the lamp under voltage fluctuations. Upon an increase in voltage the candle-power change was one-third as great as that with either tantalum or carbon filaments. On the other hand, voltage decrease caused a decrease in candle-power one-third as great as that with either tantalum or carbon. This indicated that if a ten per cent variation in candle-power were permissible there could be a voltage fluctuation of possibly fifty per cent without affecting materially the light given by the tungsten filament. Another important advantage lay in the fact that the tungsten filament could be subjected to higher voltages without disintegrating in the same fashion as the carbon filament when subjected to a higher impressed voltage than that for which it was rated.

Dr. Sharp showed a number of lantern slides and called attention to various characteristics of the several types of lamps. He showed one slide which indicated the excellent results which had been secured burning series tungsten lamps for street lighting. The poorest useful life rating shown in a large series of tests gave the tungsten lamp a commercial service of 1,400 hours with a loss in candle power of less than fourteen per cent. One of the principal characteristics which stands out above all the others in these tests is the uniformity with which the candle-power is maintained over extreme ranges of life. Through the courtesy of the New York Edison Company and the lamp manufacturers, a large assortment of incandescent lamps was available for demonstrating purposes. Most of these are well known commercially, but one to which especial attention was called was a freak lamp which has just been imported from Germany. This contains a carbon filament enclosed in a U-shaped tube. The bulb is open to the atmosphere. In the bottom of the U-tube there is a globule of mercury, and it is supposed that the heat of the filament volatilizes the mercury so that after burning a short time the filament is shunted, the main current passing over the mercury vapor column, giving the characteristic mercury vapor spectrum. The carbon filament then glows at a dull red heat and is supposed to add sufficient red rays to render the light more attractive than that ordinarily given by the mercury-vapor lamp. Dr. Sharp stated that this particular action had not been carried out in this lamp, possibly through a defect in workmanship or otherwise. He had not been able to make any tests on the lamp, and therefore could not present further data.

W. W. Freeman, chairman of the New York section, called upon S. E. Doane, chief engineer of the National Electric Lamp Association, to open the discussion.

Mr. Doane called attention to what he considered was one of the principal advantages of the tungsten lamp, namely, the quality of illumination possible with this light source. He considered that the Illuminating Engineering Society has been born at the psychological moment when it was possible for the illuminating engineer to foster such great improvements as had recently come about. Dr. Sharp, in his address, had alluded to the tungsten lamp as being the lamp of the luxurious. Mr. Doane considered that the tungsten lamp was the lamp for everybody. It was now possible with this lamp, due to its quality of light, to entirely rearrange and make a most elaborate selection of colors in decorating. Wall decorations, table decorations, frescoes, mural conceptions and other attractive forms of decoration could be shown in their true colors, due to the quality of light. The violet and the purple iris were no longer barred from table decorations because of imperfect lighting facilities. Cases had come under his observation where, although the tungsten lamp utilized one-third of the current for an equivalent amount of illumination which had existed with the old carbon lamp installation, the bills had actually increased, due to the desire of the consumer to utilize the more attractive light in a greater degree than heretofore. With regard to the displacement of the carbon-filament lamp, Mr. Doane said that necessarily this would be slow. Approximately 80,000,000 incandescent lamps were manufactured and sold last year. The increase for 1908 would be probably 20,000,000 lamps. All of the tungsten lamp factories, working under the best conditions, would not turn out more than 1,000,000 lamps this year. This was only one-twentieth of the natural increase, and less than one-eightieth of last year's consumption.

With regard to the higher candle-powers of the metal-filament lamps, he stated that the twenty-five-watt tantalum lamp was a commercial possibility, and that if it were not placed upon the market

it would be because there was not a demand for it. Concerning the tungsten lamp, he had seen a twenty-watt tungsten lamp, and this, he considered, was a feat of manufacture. He was convinced that the twenty-watt tungsten lamp was possible, and that probably sooner than we imagined we might have it as a commercial proposition.

Dr. Edward P. Hyde, physicist at the National Bureau of Standards, said that he thought the gain in the new lamps was due in one direction to the higher operating temperature of the tungsten filament, and possibly to a better selective radiation. He considered that the gain was made in the direction of the shorter wave-lengths, and that possibly this represented the larger portion of the gain in illumination.

W. J. Hammer said that he regretted the omission from the exhibit of the Heany tungsten lamp. The tests made by Waidner and Burgess, showing a melting point at 3,200 degrees centigrade, indicated that a very pure tungsten filament was being used. Mr. Hammer called attention to the difficulty of producing pure tungsten, due to its avidity for forming a carbide when heated even to a low temperature in the presence of carbon or hydrocarbons. The Heany filament, he stated, had considerable mechanical strength, and to his mind was a great step in advance.

Arthur Williams said that to him the tungsten lamp was very welcome, as it opened up the possibility of consummating the hope that he had expressed for a great length of time as a central station man. He thought that the tungsten lamp was essentially the poor man's lamp. With its increase in efficiency it was possible to compete with almost any other form of illuminant, and that instead of the electric light being used only by the rich or those of the middle classes who could afford such luxuries, it would now be possible for the poor man to have all the advantages of the better forms of illumination. He had no apprehension of the survival of the central stations, no matter how much more efficient the lamps became. He thought that the more the central station approached these problems in a broad-minded, altruistic attitude, the greater would be the gain for all concerned.

M. D. Jones, of the United Electric Light and Power Company, New York city, stated that his company had made a test of tungsten lamps on a 110-volt, alternating-current installation, using forty-two-candle-power, sixty-watt lamps. The equipment was installed in a haberdasher's, where there was an ordinarily good light in the front of the store, the goods were displayed upon the ordinary dark background, and the rear of the store was practically dark except when artificially illuminated. These lamps were burned continuously as long as the store was open, and very careful records were kept. Sixty-seven of the lamps had an average life of 588.8 hours, and included the record made by several defective lamps which either broke as soon as they were put in the socket or burned out shortly after installation. Twenty-one of these lamps burned from May 26, 1907, to January 2, 1908. These lamps had an average life of 900 hours. Five of the lamps were still burning when the test was concluded at the end of 2,110 hours. Ten of the lamps burned for 1,880 hours, and the balance had a life of from eight to 1,800 hours. Taking them altogether, it was absolutely safe to guarantee a commercial life of 900 hours. These lamps were placed mainly in a new type of fixture containing six lamps surrounding a conical parabolic reflector enclosed in an opaque hemisphere. The circuits were so arranged that two, four or six lamps could be used. The installation had proved very satisfactory, replacing arc lamps. The owner of the store was so pleased that he had displaced all of the arc lamps in favor of the tungsten clusters.

In concluding the discussion, Dr. Sharp replied to Mr. Hammer's remarks and also to several inquiries which had been made concerning the helion lamp, the operation of the tungsten lamp on alternating current *versus* direct current, the utilization of a transformer in the socket of the lamp on alternating-current circuits, so that a lower-voltage, shorter-filament tungsten lamp might be used.

He stated that sufficient data concerning either the Heany or the helion lamp had not been presented to enable him to formulate any definite statement regarding them. Probably more was known concerning the Heany lamp from what Mr. Hammer had told them than had been known before.

Concerning the helion lamp, he had read of certain tests, and he knew that the inventors, Parker and Clark, were hard at work on this proposition, and it appeared that they might have secured a very excellent article.

There was apparently no difference in the operation of the tungsten lamp, whether installed on alternating-current or direct-current circuits. The use of a transformer in the socket was entitled to a great deal of consideration, and it was probable that the best solution of this problem would be to equip the panel-board with an auto-transformer which had a number of taps, so that low voltages could be distributed to the various circuits. In this way a very efficient installation could be provided. However, if the twenty-watt tungsten lamp was a possibility, as Mr. Doane had said, there would be no necessity for this, although it was possible that the demand would still persist, due to the advantage of using a shorter filament.

Mr. Freeman stated that it was his idea that the central stations would meet the introduction of the tungsten lamp in a broad-minded manner. They would foster every improvement so that all could enjoy the greatest advantages. The central station companies would, no doubt, announce a definite policy at an early date, and this policy, he felt sure, would commend itself to every one interested.

The next meeting was announced for Thursday evening, May 14, when Dr. E. L. Nichols will present a paper entitled "Daylight and Artificial Light." Dr. Sharp said that this would undoubtedly be one of the rarest treats which the society had ever had tendered to it. A short time ago Dr. Nichols had made a trip abroad and taken with him a portable spectro-photometer, making skylight observations under every conceivable condition in Africa, on the Mediterranean, in Italy and in the high Alps. The paper would unquestionably prove of very great interest.

The meeting was then adjourned.

Final Merger of the Automatic Electric Company and the Strowger Telephone Company.

Negotiations have finally been concluded merging the Automatic Electric Company and the Strowger Automatic Telephone Company. The consideration is said to have been $1,000,000. The business will continue under the old firm name of the Automatic Electric Company. Joseph Harris, formerly president of the Automatic Electric Company, will act as president of the consolidated companies. C. D. Simpson will be vice-president; W. I. Patton, secretary; A. G. Wheeler, treasurer, and Harmon A. Harris, second vice-president. The company is capitalized at $5,250,000.

The Automatic Electric Company was incorporated in 1900. The Strowger company began business in 1891. The purchase price agreed upon was paid in shares of stock of the new corporation.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Railway Calculations.

A simplified method of calculating the performance of railway equipments under service conditions is discussed here by Malcolm MacLaren. In these calculations it is usual to simplify the work by substituting for the irregular profile of the road a uniform grade equal to the average grade between terminal points. If curves are not sufficiently severe to require slow running, the effect of these is also averaged, and instead of figuring out each individual run for a train making frequent stops, the service is studied by a single typical run equal in length to the average distance between stops. Some discretion must be used in applying this method, as it would not hold over wide limits, but with proper precautions it will give accurate results. The author then shows how this method was applied to the electric zone of the New Haven system. The average grade between Mount Vernon, N. Y., and Stamford, Ct., is less than one-tenth per cent; the average distance between stations, 1.65 miles. The individual runs vary from 0.4 mile to 2.62 miles. The curves do not materially affect the speed of the local trains, and need not be considered. From a series of tests made on trains in regular service the running time from Mount Vernon to Stamford for 200-ton trains, when the time between station stops averaged forty-five seconds, was found to be forty-seven and one-third minutes, and from Stamford to Mount Vernon, forty-eight and two-thirds minutes. The typical runs in the two directions were calculated, using an accelerating current equal to the average obtained in the tests, and taking a braking rate and period of coasting to correspond as closely as possible to the values obtained in service. The running times obtained in this way were, respectively, forty-seven and one-half minutes, and forty-nine minutes from Mount Vernon to Stamford and in the reverse direction. These figures show a close agreement with the actual results. Theoretical studies of individual runs, as made during preliminary calculations, also check closely with the results obtained from the locomotives in service. The calculated and test performances of a locomotive when hauling a 296-ton train between New Rochelle and Larchmont, N. Y., a distance of a little over two miles, are found to be in close agreement. The speed curves are practically identical up to forty miles an hour. Above this the calculated speed is slightly higher, which leads to an error of three seconds in the total running time, indicating that this would be 216, while it actually was found to be 219 seconds. The square root of the mean square current for each motor, which determines the heating of the apparatus, was 1,210 amperes; the calculated, 1,200. The power consumption for the run was sixty-six and one-half watt-hours per ton-mile, measured, and sixty-four and two-tenths, calculated. The slight difference here is due to the fact that in operation the train was not allowed to drift, but the current was held on until the time of applying the brakes. —*Abstracted from the Electric Journal (Pittsburg), April.*

The Electrical Industry in France.

The very interesting and rapidly growing electrical-transmission system of the Société Meridionale de Transport de Force is discussed here by Georges Dary. This system was described some time ago in the ELECTRICAL REVIEW, but it is continually increasing; in fact, one of the notable features of the undertaking is the necessity to plan for further extensions before the work in hand has been completed. Hardly has one section of the transmitting system been completed before the necessity of establishing a supplementary station and opening a new area becomes apparent. The demand has thus led to such increases of the transmitting system that the lines now cover two departments, over which they extend in an almost unbroken web. The system consists of over 374 miles of high-tension lines reaching a distance of a little over eighty miles from the generating station to the farthest point of consumption. The original plant is a hydraulic station at St. Georges, which was established in 1899. A new auxiliary station has been located at Aguzou at the bottom of the Gorges de l'Aude. This extends the supply as far as Beziers and Marausan. The St. Georges station, which is on the River Aude, utilizes a fall having a height of 320 feet, and power is transmitted at 20,000 volts by means of a high-tension line, forty-four miles long, to Fabrezan, from which, as a centre, three branch lines radiate—one running to Narbonne, a second to Carcassonne and the third to La Nouvelle. These three branches supply electrical energy direct to all the places on the route, but further, and mainly, serve to feed the three distributing centres named, the high-tension current being there reduced to a medium voltage; and from these secondary centres the real supply mains radiate. The demand on the St. Georges station became so great that in 1906 and 1907 three auxiliary stations were established—one at Aguzou, the second at Narbonne and a third at Carcassonne, while new high-tension lines are now projected at Castelnaudary, Couiza, Tuchan, etc. All of these stations run in parallel or else feed different stations. The Narbonne and Carcassonne stations are equipped with steam engines and continuous-current dynamos, in addition to the synchronous and asynchronous motors operated by power supplied from the St. Georges and Aguzou stations. The St. Georges station has been described. It contains four Pelton wheels, each direct-connected to a 700-kilowatt alternator generating 2,900 volts at fifty cycles. The potential is stepped up to 20,000 volts by means of three single-phase transformers for each circuit, connected in star. Since the establishment of the Aguzou plant, cables have been run from the St. Georges plant so as to connect the two stations in parallel. They may, however, be operated independently, each feeding any desired section of the system. The new station contains a turbo-alternator rated at 1,250 horse-power, but a 4,000-horse-power unit will be added shortly. The Narbonne station was first equipped with motor-generators and has now one 900-horse-power steam engine driving an 875-kilowatt, three-phase alternator. The Carcassonne station has about 900 horse-power in steam engines. Due to the difficult country through which the transmission lines run, very careful patroling is enforced. A patrol house is located every six and one-quarter miles. Here a lineman is stationed, who daily patrols

his sections and reports to the main office by telephone. Every Sunday from two in the morning until three in the afternoon power is cut off to enable repairs to the line to be carried out. The general policy followed by the power company is to construct generating stations and high-tension lines only, the substations and distributing lines being built by the local authorities.—*Abstracted from the Electrical Review (London), March 27.*

Gasolene-Electric Systems for Heavy Vehicles.

Gasolene omnibuses have been operated in London, England, for some time past, but, it is said, not profitably. In a paper read recently before the Society of Road Traction Engineers, P. F. Smith and W. A. Stevens analyzed the condition of this traffic and attributed its non-success to the inefficiency and cost of up-keep of the driving machinery. An analysis of the working costs of these gasolene omnibuses showed that the total cost was 23.874 cents a car-mile, the chief items being maintenance, which is nearly five cents a car-mile; driver's wages amounting to 2.6 cents; tires, 3.5 cents; fuel, 2.65 cents, and garage charges, 4.36 cents. These are the averages found after three years' operation. The authors then undertake to show that by an improved system of driving the expenses can be greatly reduced. The type of equipment which they suggest is one in which a gasolene engine is employed, driving a direct-current generator, which, in turn, drives two motors, each of which drives, through a specially designed worm gear, one rear wheel. The engine is rated at thirty horse-power and the generator is a shunt-wound, interpolar machine. The motors are series wound. With this arrangement no differential gear is necessary and speed variations may be obtained, if desired, by series-parallel grouping of the motors. This arrangement, however, is employed only in exceptional cases. No battery is used in the equipment. The speed in operation is controlled by varying the generator excitation and throttling the engine. Under ordinary conditions the main circuit is never broken, even at stopping. Before starting, unless the grade be very steep, the controller is put into the parallel notch with the engine running slowly and the generator field reduced. The brakes are released and the engine is accelerated by opening the throttle, so that the voltage of the dynamo rises. The field switch is gradually moved over to raise the voltage as the vehicle gains speed. The running speed is then controlled by the throttle. An equipment of this kind has been in operation for several weeks and has run about 6,000 miles in ordinary service. Its performance is said to have been satisfactory. In discussing the conditions under which the gasolene-electric system should produce the greatest efficiency it is pointed out that if the engine had the characteristics of the steam engine, without its disadvantages, giving a heavy torque at low speeds and a small torque at high speeds, or if a highly efficient universal gear of low first cost and low cost of up-keep could be produced, there would be no excuse for employing the gasolene-electric system; but in the absence of these two conditions, the continuous-current gasolene-electric system proposed, with a suitable gear as the final transmission, is thought to be the nearest approach to the ideal at present attained. Generally speaking, the electrical transmission should be so designed that by its characteristics the lack of flexibility of the gasolene engine is corrected and the necessity for a clutch and differential gear is avoided. The dynamo must run absolutely sparklessly under all conditions, and its characteristic must be such that it will develop approximately constant power independently of its speed, the voltage and current varying in inverse ratio. To this end the dynamo is designed with a falling characteristic similar to that of a shunt-wound generator. The commutating poles provide the necessary commutating field, which prevents sparking. The best gear ratios for the motors have been decided to be 12 to 1 for country work and 16 to 1 for slow speed in cities. With the latter ratio the efficiency of transmission in a van weighing, loaded, seven tons, on a grade of 1 in 12, is seventy per cent. This includes all electrical losses and allows ten per cent for gear losses. With a ratio of 12 to 1, the efficiency of transmission is found to be sixty-seven per cent under similar conditions. Under average conditions the average efficiency would be over seventy per cent. The advantages of this system, in addition to those mentioned, are the reduction in the night staff at the garage, a considerable reduction in the maintenance cost, and an increase in the mileage of each vehicle. It is thought that each can easily make 40,000 miles a year. An estimate of the cost of operation, based upon the regular running of the equipment mentioned above, shows that the total cost per car-mile for the electric system would be 18.362 cents. This allows 3.61 cents for depreciation, interest, etc., and two cents for maintenance. The wages and garage charges are put at the same figure as for the gear-driven vehicle.—*Abstracted from Electrical Engineering (London).*

The Penetrating Radiation.

The question whether the penetrating radiation of the air may not arise from active material in the air itself, rather than in the ground, is answered here by A. S. Eve. Unless the earth's supply of active matter is augmented from without, or unless it arises in a manner at present unknown, the question may be negatived and a numerical answer given with some approach to accuracy. Strutt has found 3×10^{-12} grammes of radium as the average amount present in one cubic centimetre of soil. Eve himself found 10^{-16} grammes of radium to be a measure of the amount of radium emanation present in a cubic centimetre of the atmosphere. These quantities are nearly proportional to the amounts of radium C produced for each cubic centimetre in earth and in air. The ratio is 30,000 to 1. McClelland and Wigger have found that the coefficients of absorption of the penetrating rays are proportional to the densities of their absorbers, so that the absorption of these rays from radium C by soil and by air are as their densities, about 2,000 to 1. It has also been proved that the penetrating radiations from earth and air are proportional to the ratios of the quantities of radium present to the coefficients of absorption. Hence, the penetrating radiations from the radium C in the ground, and from that in the air, are in the ratio of the two ratios mentioned above, namely, 15 to 1. Moreover, radium C is carried earthward by falling snow and dust and by the potential difference in the atmosphere, thus increasing the amount on the surface of the earth and diminishing that in the air. Hence, it may be concluded that in most localities the penetrating radiation, due to active matter in the air, is less than one-fifteenth of that due to active matter in the earth. The effect of the emanation due to thorium, on account of the rapid decay of this material and its poor chance of escaping from the soil, will doubtless show a still greater disparity.—*Abstracted from Nature (London), March 26.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Hoyt Electrical Instruments.

The accompanying illustrations show two electrical instruments which have been placed on the market by the Hoyt Electrical Instrument Works, of Penacook, N. H. These instruments are adapted particularly to the testing of ignition batteries for gasolene vehicles, although

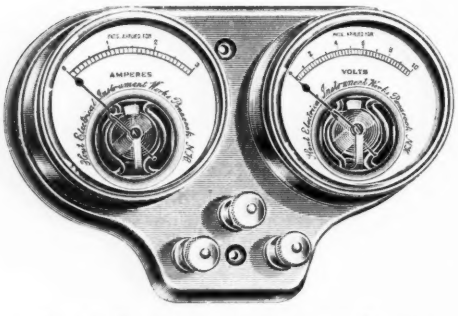


FIG. 1.—HOYT VOLT-AMMETER FOR TESTING IGNITION BATTERIES.

the company manufactures similar instruments for the testing of battery-charging outfits and other high-grade instruments for central station purposes, both in the switchboard and portable types. Fig. 1 shows a volt-ammeter for testing ignition batteries. This is constructed on the D'Arsonval principle, the coils and parts being so proportioned and designed as to take an inappreciable current from the batteries and effect no deterioration even when left constantly in circuit. Fig. 2 shows a portable volt-ammeter which has been very recently developed by the company. This instrument is encased entirely in metal, is finished in gun-metal, and the carrying case is seal leather provided with a shoulder strap. The carrying case is provided with a window, so that readings may be taken without removing the instrument from the case. The use of these instruments eliminates a great many of the uncertainties which obtain in the operation of ignition systems. The operator very readily becomes acquainted with the characteristics of his apparatus, and in almost all cases can determine where the fault lies without subjecting the entire system to overhauling.

The Hoyt Electrical Instrument Works was established in 1904 by Dr. A. H. Hoyt, who was instrumental in establishing the Whitney Electrical Instrument Company in 1891, being its first executive up to 1903, when the property was destroyed by fire and a reorganization of the company effected. He was associated with the new owners of the Whitney company from 1903 until 1904, when he resigned to establish the present enterprise. He has made a close study of the design and construction of electrical measuring instruments since 1889, and is the inventor of the well-known line of dynamometer type ammeters and wattmeters which bear his name. He became interested in the automobile industry in 1898, and has been an ardent motorist ever since. He has designed and built a number of machines, and no one realized better than himself the inadequacy of the means afforded motorists for testing the ignition system of a gasolene car. He realized that no matter how perfect a system of ignition might be, it could not remain so as long as the operator was obliged to operate it by guesswork, and so he early turned his attention to designing a line of instruments which could be offered at a reasonable price and which would, at the same time, be sufficiently compact to permit of use on the dashboard of a gasolene machine.

Dr. Hoyt has been ably assisted by J. A. Massie, superintendent of the Hoyt Electrical Instrument Works, in the development of these instruments. Mr. Massie's early training was secured in the railway field, and he entered the employ of the Whitney Electrical Instrument Company in 1892. From 1896 until 1899 his work lay largely with marketing the product, and from 1899 to 1903 he filled the position of superintendent. From 1903 to 1906 he was secretary with the Whitney Electrical Instrument Company, and from 1904 he also filled the position of manager of the Penacook factory. In April, 1907, he became associated with Dr. Hoyt in the Hoyt Electrical Instrument Works.

FIG. 2.—HOYT POCKET VOLTMETER FOR TESTING IGNITION BATTERIES.

Receiver for Consumers' Electric Company, of New Orleans.

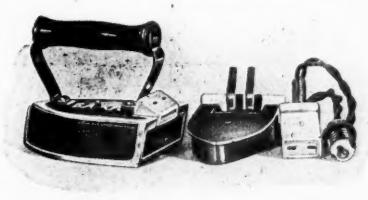
Samuel Insull, president of the Commonwealth Edison Company, Chicago, has been named as receiver for the Consumers' Electric Company, of New Orleans, La. The company has a capital stock, bonds and other obligations aggregating about $2,500,000. The receivership was asked for by the National Conduit and Cable Company, holder of $1,500,000 first-mortgage bonds of the Consumers' company. The petition for receivership declared that the company had defaulted in payment of interest due on the bonds, but the amount was not stated.

The Consumers' Electric Company is one of the two companies supplying electric light and power in New Orleans.

A New Barr Electric Flat-Iron.

The Barr Electric Heating Company, Cleveland, Ohio, has placed on the market a new electric flat-iron which embodies a number of important features that make it peculiarly available for meeting the demands of various classes of operators. This iron is the result of a large manufacturing experience and a close study of the requirements of the operator and the demands of the trade.

Careful and exhaustive tests indicate that this iron will meet every requirement.



Elements of Barr Electric Flat-Iron.

The company has gone to great expense in making special machines for the manufacture of the heating unit. The object was not only to reduce the cost, but to insure uniformity of workmanship, and the company can therefore guarantee that if one heater stands the test, all will, because they are all made exactly alike. Under endurance tests the heating units have not yet been broken down. The resistance material is not wire, and will not corrode or disintegrate.

One of the difficulties with which dealers have had to contend in distributing

New Barr Electric Flat-Iron.

flat-irons is due to the different ways in which several operators handle their work. One operator might iron very fast and the other slowly. Some operators iron clothes while wet, while others iron clothes when they are almost dry. If the fast worker should also desire to iron the clothes wet, he would require an iron generating much more heat than would the slow worker ironing dry clothes. It was decided that the best way to overcome this trouble was to design an iron so that the heating unit could be easily removed by simply loosening one screw. This screw is placed in the centre of the top of the iron. By giving it a few turns backward the heating unit can be drawn out by pulling on the terminal posts. The unit slides out easily, and there are no electrical connections to make. By this arrangement a unit generating more or less heat, as required, can be substituted by the operator, thus relieving the dealer of this annoyance. This feature is expected to prove one of the most valuable features of the new iron.

The contacts and contact plug are large and strong, and the conductor cord is knotted inside the plug, so that pulling on the cord will not sever the electrical connection.

The iron is furnished complete with six feet of conductor cord, plugs, and an approved heat-resisting stand. The resistance unit is guaranteed by the manufacturer for one year, with no restrictions.

The Barr Electric Heating Company is a new company, and is not connected in any way with the W. J. Barr Electric Manufacturing Company, of Cleveland. The manufacture of the new iron is under the personal supervision of W. J. Barr. A. F. Brown is eastern representative of the company, with offices at 120 Liberty street, New York city.

Lighting and Traction Conditions in the West.

Representatives and correspondents of Spencer Trask & Company, the bankers controlling large holdings in central station and street railway properties, have recently returned from a trip of inspection of the properties of the Milwaukee Electric Railway and Light Company, the Milwaukee Light, Heat and Traction Company, the Detroit Edison Company and the Cleveland Electric Illuminating Company. The following statement has been given out:

"In each case the party was greatly impressed with the excellent condition of the plants and the broad and comprehensive plans on which the construction has been carried out. With every degree of conservatism, the various companies are planning additions and improvements to provide for the increased requirements which are already evidenced, and which may reasonably be expected to be upon a constantly increasing scale.

"The general business conditions in Milwaukee, Detroit and Cleveland were found to be those of quiet confidence that after the Presidential election the volume will be gradually restored to normal proportions. In the meantime operations are being curtailed, thus avoiding any danger of overproduction, which must have the ultimate effect of bringing about a more rapid recovery than would be otherwise possible.

"In the investment field there seems to be an abundance of funds awaiting investment in the best class of securities of sound properties, but owing to the recent panic individual investors are evidently, and quite naturally, more determined than ever to place their funds only in securities combining safety of principal and interest and promising reasonably large appreciation in value. It is not unlikely, therefore, that this feeling will have its effect on local legislation pending the country over, making it apparent that in order to raise the necessary cash to provide ample facilities for the convenience and comfort of the public, the laws governing utility corporations must not be burdensome, but reasonably fair to both the corporations and the public."

Interborough's $55,000,000 Mortgage Approved.

The Public Service Commission of the First District, state of New York, has approved the application of the Interborough Rapid Transit Company to execute a mortgage of $55,000,000 on its property to secure an immediate issue of $30,000,000 bonds for refunding its indebtedness. The Interborough company has informed the commission that a contract has been signed for the reconstruction of the tracks in the Manhattan subway from Ninety-sixth street to One Hundred and Third street. North of Ninety-sixth street there are only three tracks to the junction at One Hundred and Third street, where the subway branches to the east and west. The addition of a fourth track will facilitate the movement and switching of trains. The cost of the improvement will be about $850,000.

Grand Rapids Electrical Show.

An electrical exposition will be held from May 11 to May 16 by the Grand Rapids Electrical Show Association, which has been formed at Grand Rapids, Mich. The secretary of the association, W. J. Fenton, is in charge of the preparations. Fifteen thousand square feet of space is available for the show in the Waters Building. The Grand Rapids-Muskegon Power Company will occupy 1,000 square feet of exhibit space, and a number of other large allotments have already been made.

United States Civil Service Examinations.

The United States Civil Service Commission announces an examination on May 6 to secure eligibles from which to make certification to fill a position of assistant engineer, $900 per annum, office of the Attorney-General, Washington, D. C., and a vacancy in the position of engineer, $1,020 per annum, Freedmen's Hospital, Washington, D. C., as well as vacancies requiring similar qualifications as they may occur. Applicants who have had experience in plumbing should so state in their applications, as such experience is required for the position in Freedmen's Hospital.

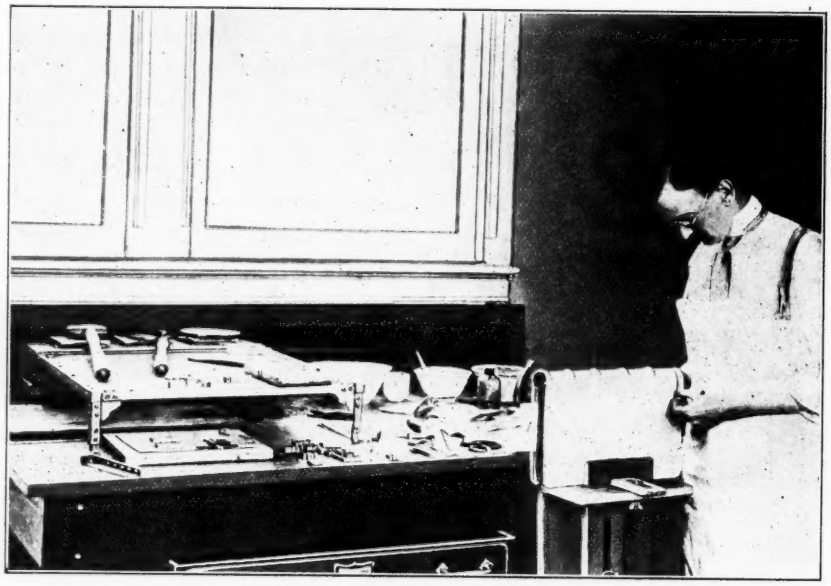
An examination will also be held on May 6 to secure eligibles from which to make certification to fill a vacancy in the position of switchboard attendant, $900 per annum, United States Military Academy, West Point, N. Y., and vacancies requiring similar qualifications as they may occur in any branch of the service. Applicants for this examination should be practical electricians. The age limit is twenty years or over on the date of the examination, and the examination is open to all citizens of the United States. Applicants should at once apply for application form 1,093.

Hadaway Heating Apparatus for Bookbinders.

Electric heat in the bookbindery presents decided advantages over gas. Being absolutely clean, it prevents spoilage, and, being more efficient, reliable and convenient, it enables the workman to devote more attention to his work and to get better results.

One of the most successful of the electrical devices now manufactured for the bookbinder is the Hadaway hand-tool heater. It consists of an electrically heated plate surrounded by a platform of heavy wire fabric. It is large enough to heat a number of tools at a time, and the platform provides a suitable support for the handles of the tools being heated, and a convenient place to cool off the tools that have been used. This method of heating the tools is expedient and satisfactory, permitting great freedom to the workman, and enabling him to maintain the exact temperature required. The simplicity of the device is shown by the accompanying illustration.

Two other electrically heated devices that are rapidly gaining favor with bookbinders, illustrated herewith, are the stamping press and the glue-pot. The finer sort of work that the binder has to do requires great cleanliness to make it profitable, while edition and pamphlet work require despatch. These electrical devices fulfil both requirements. They are always ready for service and always maintain a uniform temperature, so that no delay need ever be experienced.



HADAWAY ELECTRICAL HEATER FOR BOOKBINDERS' TOOLS.

The design of the stamping press head is such that the heater and its insulation is entirely protected from the direct pressure, the head being practically a solid block of iron. This form of construction is very rigid and the head has no tendency to give and reduce the pressure. The heating element is divided into sections, permitting the heat to be localized in the centre or in the ends, or to spread over the entire head, as desired.

HADAWAY ELECTRICALLY HEATED STAMPING PRESS AND GLUE-POT.

The glue-pot is provided with a patent water-circulating device that brings the glue up to the proper temperature in much less time than would be otherwise required, and with a cutout which reduces the current so that just enough is used to keep the glue at a fixed temperature.

These devices are manufactured by the Hadaway Electrical Heating and Engineering Company and sold by the Westinghouse Electric and Manufacturing Company.

Meeting of the Pittsburg Section of the American Institute of Electrical Engineers.

The April meeting of the Pittsburg section of the American Institute of Electrical Engineers was held in the lecture hall of the Carnegie Institute. Twenty-eight members attended the usual informal dinner at the University Club immediately preceding the meeting. The general subject of the meeting was "The Application of Motors to Rolling-Mill Work."

James Farrington, electrical superintendent of La Belle Iron Works, gave the principal paper of the evening on "The Relative Advantages of Various Methods of Operating Reversing Mill Tables." Mr. Farrington gave complete figures of the amount of power and the speeds required at all parts of various reversing mill tables, the weights and inertia of the various rolls, ingots, etc. He compared motors with various gear ratios and tandem arrangement. In summing up the question, it seems that if the number of accelerations or reversals be increased and the running time in a cycle be decreased, the smaller gear ratio will require less power or kilowatt-hours.

Comparing the results of a test on the 128-inch plate mill at Homestead with a test on the eighty-four-inch plate mill of La Belle Iron Works at Steubenville, we have the following:

	128-Inch Mill.	84-Inch Mill.
Gear ratio.....	1 to 10	1 to 2
	One 75-H.-P. Motor.	Two 50-H.-P Motors.
Total inertia of rollers	5,000 lbs.	4,450 lbs.
Total inertia of ingot	950 "	...
Total	5,950 lbs.	4,450 lbs.
Speed of motor.	850 r.p.m.	160 r.p.m.
Armature accelerating current	340 amp.	275 amp.
Armature running current..	80 "	185 "
Square root of mean square current	147 "	207 "

This shows that the eighty-four-inch mill tables require sixty amperes more current to operate empty than the 128-inch mill, but its peak-loads are smaller.

W. A. Dick read a paper on "The Application of Motors to Rolling-Mill Work." He made mention of the necessity of having rugged motors for this work, which are able to stand a high temperature without burning out. He recommended the open motor for mill work when it was possible to place it in a separate room free from mill dust. The open motor ventilates better and can be cared for more easily. The direct-coupled motor to rolls is preferable. The motor should have plenty of power, as it is expected to turn out more product than the steam engine. Over fifty per cent compounding works out best for mill motors.

Mr. B. Wiley, of the Westinghouse Electric and Manufacturing Company, also read a paper on "The Application of Motors to Rolling-Mill Work," and explained the necessity of having flywheels to take up the sudden strains put upon the motors. This applies especially to motors for shearing machines. The time for performing most of these operations is measured in seconds: for instance, the period of cutting, two seconds; the period between cuts, six seconds.

W. Edgar Reed, consulting engineer, gave an interesting talk on mill motors. He stated that even with increased efficiency of steam engines it does not seem possible to bring the cost of power down to that of gas-engine power, because using the gas in this way will give about two and one-half times the power that it would if used for firing a boiler and the operating of a steam engine. He thought that a suitable gas engine could be made or would soon be made for reversible work and speed regulation to compete with electric drive. Reversing coupling employing coiling effect of spring was mentioned.

For reversing steam-engine mills, where the head roller can use any desired drafts, the engine is built with the hope that it will break down the mill—and the mill is designed with the hope that it will break down the engine, the master mechanic always hoping that neither will break. The general belief was that electric motors built under these conditions would be too expensive to use, and that smaller ones would be installed which would be blocked when heavy drafts were taken, and that the motors would burn out. Or the general opinion seemed to be that electrical installations would be made with smaller motors than steam-driven installations, and that the control would allow the electric motors to be used in such a way that they would be overloaded and burned out, until this matter was thoroughly explained.

Slides were explained of the following: 1,500-horse-power motors at Edgar Thomson Works; connection of these motors to rail mills; 4,000-horse-power reversible rolling-mill motors; 9,000-horse-power reversible rolling-mill motors; equalizer sets; connections, electrical and mechanical, for the 9,000-horse-power motor to rolls; curves of power required for operation of certain reversing mills; curves of power required for operation of certain continuous mills.

In the general discussion Mr. Friedlaender, of the Duquesne Steel Works, stated that they had two motors that had been running two and one-half years without a dollar's repair. No additional oil is required, and the motors look clean and new. They are located in separate rooms. The motor shaft is very heavy, twenty-eight inches in diameter, while the coupling to the rolls is only seven inches in diameter.

C. T. Henderson, of the Cutler-Hammer Manufacturing Company, spoke of European and American practice for rolling-mill motors, especially the reversing mill. He favored the design of a three-high mill, non-reversing.

It was mentioned that a mill for the Tennessee Coal and Iron Company had been built in Wheeling which was so well controlled that the ingot could be stopped very suddenly and just in the position desired.

Commercial Day Programme, National Electric Light Association.

One of the most interesting features of the coming convention of the National Electric Light Association, which will be held at the Auditorium Hotel, Chicago, Ill., May 19-22, will be Commercial Day, Thursday, May 21. H. J. Gille, of the Minneapolis (Minn.) General Electric Company, will present a paper entitled "Preparation of a Campaign." This paper has been divided into five sub-titles and will consider: (a) field work and other essentials; (b) analysis of customers' accounts; (c) proportion of lamp equivalent lost to lamps connected, showing percentage in cities of varying population; (d) policy of handling complaints; (e) policy of handling collections.

A selected corps of assistants will help Mr. Gille edit and compile the matter for this paper. These editors have been selected from communities where the conditions vary widely, and the paper will be one of the lively issues of a thoroughly-alive commercial campaign.

Louis A. Ferguson, vice-president of the Commonwealth Edison Company, Chicago, has accepted the editorship of one of the special features of the Commercial Day programme. This will be a paper on "The Relation Between the Engineering and Commercial Departments."

Current Electrical News

DOMESTIC AND EXPORT.

TO COMPLETE FROST LINE—Judge Peter Grosscup, of Chicago, Ill., has authorized the issuance by the receivers of the Chicago & Milwaukee Electric Railroad Company of $1,000,000 in receivers' certificates in order to enable them to immediately complete the road between Chicago and Milwaukee, Wis.

FIVE-MILLION-DOLLAR RAILROAD MORTGAGE—The Little Rock (Ark.) Railway and Electric Company has filed a mortgage executed to the Bank of Commerce and the Trust Company of Memphis for $5,000,000. Of this, $2,000,000 is to take up outstanding bonds and the remainder to provide for future developments.

MEXICAN ELECTRIC TRAMWAYS COMPANY TO ISSUE $15,000,000 OF NEW BONDS—The Mexican Electric Tramways Company has concluded an arrangement with the National Trust Company, of New York, for issuing new bonds to the amount of $15,000,000 gold. Part of the money will be used for the redemption of outstanding liabilities, and the rest for the improvement of the system.

CHICAGO TRACTIONS—The board of supervising engineers has ordered the Chicago City Railway to spend $2,112,000 on forty-three and one-quarter miles of track this year and $316,000 on conduit work. Its cars must be taken off Michigan avenue. No order regarding new equipment was issued, as it has sufficient. The Chicago Railways Company was ordered some time ago to spend $2,000,000 this year, largely for new equipment, and another order will issue covering track construction work.

UNITED RAILWAYS INVESTMENT COMPANY—The United Railways Investment Company announces that the entire issue of $3,500,000 six per cent serial notes of 1908 has been subscribed. This issue of notes is for the purpose of providing means to enable the United Railways Investment Company to acquire, at par, $3,500,000 of the first preferred seven per cent stock of the United Railroads of San Francisco, being the balance of $5,000,000 authorized issue of that stock, of which $1,500,000 was acquired in 1907 by the United Railways Investment Company. The United Railroads of San Francisco report gross earnings for March $558,524 approximate, which compares with $537,700 for March of last year, showing an increase of 3.87 per cent.

THE WHITNEY COMPANY—The bondholders' meeting, called to consider the plan of A. O. Brown & Company, for a reorganization of the Whitney Company, which has been developing a large water power on the Yadkin River, North Carolina, has been postponed indefinitely. The new financial plan involves the formation of a new corporation, which is to issue $5,000,000 five per cent first mortgage twenty-year construction bonds; $5,000,000 of seven per cent non-cumulative preferred stock, and $5,000,000 common stock. Present holders of the company's bonds are asked to surrender them at fifty per cent of par, for income bonds. The Whitney Company was placed in receivers' hands on February 3, John S. Henderson, of Salisbury, being named as receiver. On April 4 Charles W. Smith, of Granite Falls, N. C., was appointed co-receiver.

NEW MANUFACTURING COMPANIES.

CHICAGO, ILL.—The Jove Manufacturing Company has been incorporated to manufacture electrical devices, with a capital of $5,000. The incorporators are: Percy Saylor, Allen H. Pratt and H. D. Payne.

TRENTON, N. J.—The Lutz-Lockwood Manufacturing Company has been incorporated to manufacture and deal in electric batteries, supplies, motors, vehicles, machinery, etc., with a capital of $100,000. The incorporators are: R. M. Barwise, W. Dodd, C. W. Low, Roselle.

TELEPHONE AND TELEGRAPH.

BATAVIA, N. Y.—The Bell Telephone Company has placed in operation its new exchange building. The exchange has a capacity of 5,500 lines.

NASHVILLE, ILL.—The New Minden Mutual Telephone has made arrangements to connect its line with the Washington County Mutual Company.

ROCHESTER, N. Y.—The Bell Telephone Company has awarded to Gorsline & Swan a contract for the construction of its new Genesee exchange. The building will cost $15,000.

TECUMSEH, NEB.—A new telephone company has been organized at Cook, in the northern part of this county. The officers are: President, J. E. Proffitt; secretary, G. R. Dorsch; treasurer, S. B. Wilson. Directors: G. C. Betzelberger, C. A. Nelson, Joseph H. Whitham, G. H. Fisher, Guy Hall, J. E. Proffitt, Jacob Oetkin, S. B. Wilson and G. R. Dorsch.

HUNTINGDON, TENN.—A charter has been granted to the McKenzie Home Telephone Company at that place, the company being capitalized at $1,500. The incorporators are: R. J. Parnel, H. L. Sexton, J. C. Blackburn, B. C. Manley and J. E. Mosely. The promoters will put in a system to connect with independent lines at Trezevant, Gleason, Atwood and other places. They have an assurance of about 200 subscribers in McKenzie. The system will be in operation some time in April.

SPENCERPORT, N. Y.—The directors of the Ogden Telephone Company and representatives of the Inter-Ocean Telephone Company, of Buffalo, held a meeting on April 4 at which a contract was drawn up and signed, according to the conditions of which the Inter-Ocean Telephone Company is to build and equip a new telephone line for the sum of $16,000. The line is to be completed by July 4, 1908. The contract calls for 400 telephones and two exchanges, one in this village and one at Adams Basin. Work has been commenced.

NEWARK, OHIO—At a meeting of the directors of the Newark Telephone Company it was voted to retire $5,000 of the bond issue, to pay the regular semi-annual interest on the bonds of three per cent and to declare the regular quarterly dividend on the common stock of two per cent. The report for the first two months of this year showed an increase over the first two months of 1907 of $1,200 in the gross earnings, with an increase of only $100 in the expenses. The affairs of the company were shown to be in a very flourishing condition. Considerable work is being planned for the coming season.

OBITUARY NOTE.

MR. ALBERT K. HISCOCK, treasurer of the Auburn & Syracuse, Rochester, Syracuse & Eastern, Syracuse, Lake Shore & Northern, and Syracuse & South Bay electric lines, and managing director of the Auburn & Northern Electric Railroad Company and the Oswego Traction Company, died at his home in Syracuse, N. Y., on April 7. Several weeks ago he submitted to an operation for stomach trouble. Mr. Hiscock was president of the State Bank of Syracuse, and was also a director in a number of construction companies building trolley roads, and other transportation companies.

EDUCATIONAL NOTE.

THE HEBREW TECHNICAL INSTITUTE—The annual report and catalogue of the Hebrew Technical Institute, New York city, for 1908, have been published. These books form very interesting reading and give a complete listing of the graduates of the day and evening schools.

ELECTRIC RAILWAYS.

NAZARETH, PA.—The Allen Street Railway Company has been granted a franchise by the town.

PAVILION, N. Y.—The commissioner of highways has granted the Rochester, Scottsville & Caledonia Electric Railway the right to cross certain highways in Pavilion.

ELLICOTTVILLE, N. Y.—A trolley line from Ellicottville to East Otto, it is said, will be built this spring. The right of way and a subscription of $15,000, which was required by the promoters, have been secured.

DETROIT, MICH.—Projectors of the Detroit & Adrian Electric Railway held a conference recently with the board of commerce transportation committee, and say they expect to have construction well under way this summer.

JACKSONVILE, TEX.—At a special meeting of the city council a franchise was granted over and through the streets of Jacksonville for the electric interurban railroad now being promoted by H. L. Norton, of Boston, Mass.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat and Power Company will expend about $50,000 this year in enlarging the capacity of its power plant at Main and Felix streets. Two boilers will be added, making ten in all.

EASTON, PA.—Philadelphia capitalists are said to be endeavoring to secure control of the Northampton Traction Company, which has lines running from Easton to Bangor and Nazareth. The scheme is to extend the line to Delaware Water Gap.

BROOKINGS, S. D.—The officers of the company which was organized to construct an electric railroad from Brookings to Sioux Falls are making active preparations to resume the work of construction. In the near future the work of grading and rail laying will be resumed.

WEST CHESTER, PA.—A corps of surveyors is at work on the new trolley line from West Chester to Wilmington. Arrangements have been made for the increase of the capital stock from $254,000 to $500,000, for the increase of the indebtedness, and for other details of the business.

JOLIET, ILL.—The Joliet & Southern Traction Company, now running from Joliet to New Lenox, has completed a deal for financing an extension of the system to Blue Island at a cost of $500,000. There it will connect with a Chicago line. The extension will be completed within a year.

FAIRMONT, VA.—Surveys for the extension of the Fairmont & Clarksburg Traction Company's trolley system from Grasselli to Bridgeport, are being made. Definite plans for the construction of the line have not yet been made by the company, but it is believed the work will be started at an early date.

BROOKLYN, N. Y.—Work has been begun on the laying of the third rail for the extension of the electric service of the Long Island Railroad from Belmont Park to Hempstead. It is expected to complete it by May 15, in time for the opening of the Brooklyn subway extension to Flatbush avenue. The cost of the entire work will be $90,000.

PADUCAH, KY.—The Royal Investment Company, of Minneapolis, has closed a deal with the Kentucky & Ohio River Interurban Railway Company, of this city, to construct fifty miles of electric railway, connecting Cairo, Ill., and Paducah; also purchasing $1,000,000 of first mortgage bonds. This insures two interurban lines for Paducah. The other is to be built to Mayfield.

CHICAGO, ILL.—The Calumet & South Chicago Railway Company, with a nominal capitalization of $1,000, has been incorporated at Springfield. The new company is planned to take over the properties of the Calumet Electric and the South Chicago City Railway companies, which are to be combined under the terms of the franchise granted by the Chicago city council.

SPRINGFIELD, ILL.—It is announced by A. N. Fisher that the Pana-Mattoon-Hillsboro Electric Railroad will be built this summer. The proposed line will tap a rich country. It will also act as a connecting link in the line from Indianapolis to St. Louis, which is under consideration, connecting at Mattoon with the Charleston line. A new line from Charleston to Terre Haute will complete the link.

OMAHA, NEB.—The stockholders and directors of the Omaha-Hastings electric line have elected the following officers: T. E. Schaaf, of Lincoln, president; A. Texter, David City, vice-president; C. Deeter, Omaha, secretary; E. Long, David City, treasurer. Directors: E. Long, A. Texter, David City; B. F. McDaniel, Trumbull; T. E. Schaaf, Lincoln; H. Fricke, Osceola; F. Helm, Omaha; J. H. Rodgers, Hastings.

MUSKOGEE, OKLA.—A company has been formed here for the purpose of building an electric line from Muskogee to Clarksville, Coweta, Browen Arrow and Tulsa, a distance of fifty-four miles. The idea is to open up one of the richest grain, cotton and truck growing sections in the state. The line will be designed for freight as well as passenger service. It would cross the Arkansas River bridge at Clarksville, and extend up the north side of the river.

CINCINNATI, OHIO—At the annual meeting of the stockholders of the Cincinnati, Newport & Covington Light and Traction Company, which is a New Jersey corporation, held at Newark, N. J., these directors were elected: C. M. Thurnauer, J. C. Ernst, Julius Fleischmann, J. M. Hutton, Joseph S. Trevor, R. W. Neff, C. P. Garvey and T. S. Hamilton, of Cincinnati, and Randolph Rodman, of Newark. Messrs. Neff, Garvey and Hamilton are new members of the board.

ST. LOUIS, MO.—The St. Louis, Troy & Eastern Railroad, a steam line running into East St. Louis from the Madison County coal fields, will, it is announced, either be converted into an electric line or equipped with motor-cars this summer. E. H. Conrades is authority for this statement. The Troy & Eastern hauls into East St. Louis a daily average of 5,000 tons. The road reaches several towns, among them Maryville and Troy, which would provide a good passenger business.

LITTLE ROCK, ARK.—The organization of the Little Rock-Pine Bluff Traction Company, which was chartered some time ago with a nominal capital stock of $50,000, has been perfected. W. F. Campbell has been elected president and the work of securing right of way will be actively pushed. About one-half of the right of way needed has been obtained. The route of the road will be along the south bank of the Arkansas River for a considerable portion of the distance between the two points.

PLYMOUTH, MASS.—At a meeting of the stockholders of the Plymouth, Carver & Wareham Street Railway Company it was voted to dissolve the affairs of the company, pay its debts and distribute the remaining capital to the stockholders. The company was organized in December, 1903, for the purpose of constructing a street railway from Plymouth through Carver to Tremont and Wareham. The company was capitalized at $45,000. It is stated that the constantly increasing prices of material brought the cost of construction considerably above the available capital. The stockholders will receive seventy-five per cent of the value of their stock.

RICHMOND, VA.—An electric line, running from Fulton to Warwick Park by way of Chatsworth, along the route of the old Osborne Turnpike, in Henrico County, will, it is announced, soon be in course of construction, backed by northern capital. Colonel C. P. E. Burgwyn, engineer of the proposed electric line, says: "The line will cost about $100,000. The company organized to operate the new electric line holds a charter from the state legislature of 1902 under the name of the Southern-Richmond Railway Company." It is believed that Colonel Burgwyn and his associates will secure a new charter similar to the old and push the work of construction as soon as right of way is secured.

JACKSON, MISS.—A plan is on foot in Copiah County to construct an interurban railway system in the form of a loop connecting the towns of Hazelhurst, Brown's Wells, Barlow and Dentville. The chief promoter of the enterprise is J. W. Abernathy, who states that he has a single-rail system, covered by patents, that will prove thoroughly practicable in working operation, and as a proof of his belief, he is willing to furnish one-third of the necessary capital. It is estimated that the construction of the line would cost about $3,000 per mile, the road to be about forty miles in length. The project was discussed rather extensively three years ago, but did not develop into the organization of a company for the purpose.

NEW INCORPORATIONS.

DETROIT, MICH.—Rae Electrical Company. $50,000.

LANSING, MICH.—North Burns Telephone Company. $10,000.

MADISON, WIS.—Viroqua Electric Light Association. $25,000. Incorporators: Albion and William F. Lindemann, Viroqua.

BUFFALO, N. Y.—Riley Electrical Company. $20,000. Directors: Denis A. Whitney, Philip M. Riley and Albert M. Holland.

PIGEON, WIS.—Pigeon Valley Farmers' Telephone Company. $10,000. Incorporators: S. D. Simrod, J. J. Staff and A. N. Andersen.

HARRISBURG, PA.—North Lebanon Electric Light and Power Company; $5,000. Bunker Hill Electric Light and Power Company; $5,000.

BOISE, IDA.—Rathdrum Electrical Company of Rathdrum, Kootenai County. $10,000. Incorporators: Ansel O. Skinner, Samuel Young.

LOS ANGELES, CAL.—Standard Gas and Electric Company, Los Angeles. $50,000. Incorporators: Walter S. Cramp, Horace Slater, R. J. Dunn.

ALBANY, N. Y.—The Chateaugay Telephone Company, Chateaugay, Franklin County. $2,000. Directors: M. J. McCoy, C. H. Keefe, J. G. Wills, Chateaugay.

LITTLE ROCK, ARK.—Winslow Telephone and Electric Company. $10,000. George A. Yoes, president; O. M. Whitsey, vice-president, and George A. Winn, secretary-treasurer.

DOVER, DEL.—The Elk River Heat, Light and Power Company, Newark. $100,000. Incorporators: S. M. Donnell, Newark, Del.; E. W. Meloney, Arondale, Pa.; B. F. Groff, Lancaster, Pa.

BERNESVILLE, MINN.—Buffalo River Telephone Company, Moorhead. $10,000. Officers elected: President, Jorgen Jensen; vice-president, Gustav O. Lee; secretary, C. Grover; treasurer, Theodore Skreil.

GUTHRIE, OKLA.—Oklahoma-Shawnee Interurban Company, Oklahoma City. $300,000. Incorporators: W. H. Wyatt, A. M. Spencer, Stephen Brown, Joseph Brown and J. A. Stevenson, all of Oklahoma City.

SALINA, CAL.—Gonzales Electric Company, Gonzales. $75,000. To carry on a general light, heat and power business. Directors: E. Johnson, of Oakland; H. M. Pitman, of Calistoga, and M. C. Clark, of Gonzales.

HOUSTON, TEX.—Brenham & Long Point Telephone Company. To build a line from Brenham to Long Point and from there to Burton and to Gay Hill. $2,000. Officers: A. Kamarer, president; E. H. Kelm, secretary, and Otto F. Kieke, treasurer.

ALBANY, N. Y.—Orange & Cronomer Lakes Power and Electric Company. $100,000. Directors: A. H. Ferber, Stapleton, S. I.; Emily T. Henning and Mertie C. Krug, of New York. To perfect an electric light plant, using water of the Plattekill for power.

PORTLAND, ME.—Ebersole Construction Company. Organized at Portland for the purpose of constructing, operating and maintaining telegraph and telephone lines, and for other purposes. $200,000. President and treasurer, Frank E. Ebersole, of Portland.

AUGUSTA, ME.—New York & Ontario Power Company. Organized at Kittery for the purpose of dealing in stocks, bonds and mortgages and for other purposes. $1,500,000. Officers: President, Horace Mitchell, of Kittery; treasurer, S. J. Morrison, of Portsmouth, N. H.

SPRINGFIELD, ILL.—Illinois Inland Traction Company. To build a traction line from Chicago to Kankakee. $100,000. Incorporators: Carey W. Rhodes, Elmer Schlesinger and Edwin D. Lawlor, of Chicago; Edward Doepp, of Blue Island, and Hal C. Bangs, of Glencoe.

RALEIGH, N. C.—Leaksville Light, Power and Milling Company, Leaksville, Rockingham County. Purpose: Operation of lighting plants, electrical engineering, furnishing electric power and operation of flouring and grist mills. $125,000 authorized and $10,000 subscribed by E. B., J. B. and J. C. King.

BOZEMAN, MONT.—Gallatin Valley Electric Railway. To construct thirty miles of rural trolley lines through Gallatin Valley, the first rural trolley line in Montana. The company gets a bonus of $100,000. Incorporators: W. H. Winfree, an attorney of Spokane, and Hartman Brothers, attorneys of Bozeman.

ALBANY, N. Y.—The Wallkill River Company, of the village of Walden. To sell and lease lands, water and water rights and to construct, maintain and operate dams, power plants, etc. $250,000. Directors: A. J. Fowler, of Walden and Newburgh, and C. B. Fuller, J. E. Fuller, Walter Greer and G. B. Townsend, of New York city.

HARRISBURG, PA.—Ellwood City & Wurtemburg Electric Railway Company. To construct a three-mile line from Ellwood City to Wurtemburg. $18,000. Directors: J. T. Macklin, Frisco, Beaver County, president; John M. Curry, S. P. Turner, J. N. Kirker, S. C. Van Gorder, H. G. French and J. H. Newton, Wurtemburg, and J. Z. French and A. Tortier, Ellwood City.

ALBANY, N. Y.—The Hudson & Long Island Traction Company, of New York. $50,000. Formed to operate a street surface line four and one-half miles long from Twelfth avenue and West Forty-second street, New York, to the plaza of the Blackwell's Island Bridge in Long Island City. Directors: Frederick K. Morris, Anthony Stumpf, of New York; William B. Spencer, of Montclair, N. J.

BAY MINETTE, ALA.—The City Ice and Light Company. $20,000. Incorporators: E. G. Nelson, O. E. McMillan, A. G. Martin, J. H. Farrar, J. S. Lambert, Jos. Hall, C. E. Eubanks, Earl Nelson and W. D. Stapleton. Officers are: Edward G. Nelson, president; A. G. Martin, vice-president, and O. E. McMillan, secretary and treasurer. The company will at once begin the manufacture of ice and will later arrange to furnish the town and its people with electric light.

LITTLE ROCK, ARK.—Essex Valley Land, Township and Improvement Company, of Hot Springs. $50,000, $27,000 subscribed. Principal purpose, to establish and operate an electric line from Hot Springs to Potash Sulphur, a suburb of the Valley City. Incorporators: W. S. Kirkham, John A. Riggs, M. Kinney, E. L. Richards, W. J. Boyer, Charles R. Fox and Will A. Kirk. John A. Riggs is president of the company; W. A. Kirk, vice-president, and E. L. Richards, secretary and treasurer.

DATES AHEAD.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 22-23.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, Iowa, April 23-24.

American Electrochemical Society. Next meeting, Albany, N. Y., April 30-May 2.

Nebraska Electrical Trades Association. First annual electrical show, Auditorium, Omaha, Neb., May 4-9.

Illinois State Independent Telephone Association. Annual convention, Champaign, Ill., May.

Nebraska Electrical Association. First annual meeting, Omaha, Neb., May 6-7.

West Virginia Independent Telephone Association. Annual meeting, Fairmont, W. Va., May 7-9.

Southwestern Electrical and Gas Association. Annual convention, El Paso, Tex., May 7-9.

Railway Signal Association. Next meeting, New York city, May 12.

Grand Rapids Electrical Show Association. First show, Grand Rapids, Mich., May 11-16.

Ohio Society of Mechanical, Electrical and Steam Engineers. Next meeting, Columbus, Ohio, May 15-16.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Telephone Association of Texas and Louisiana. Annual meeting, Dallas, Tex., May 25-27.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Guthrie, Okla., May 25-27.

American Society of Mechanical Engineers. Annual meeting, Detroit, Mich., June 23-26.

American Institute of Electrical Engineers. Annual meeting, Atlantic City, N. J., June 29-July 2.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

PERSONAL MENTION.

MR. H. VANCE LANE has been elected president of the Rocky Mountain Bell Telephone Company, succeeding George Y. Wallace, who remains chairman of the board of directors.

MR. MELVILLE DOZIER, general manager of the proposed Vallejo-Northern electric line, has resigned to accept the position of assistant general manager of the Northern Electric Company, of Chico, Cal.

MR. JOHN F. OLMSTED, of Buffalo, N. Y., has been nominated by Governor Hughes as a member of the Public Service Commission of the Second District, state of New York, in place of Charles Hallam Keep, of Buffalo, who recently resigned to accept the presidency of the Knickerbocker Trust Company, of New York.

HON. W. T. JAMES, mayor of Hamilton, Bermuda, is spending a brief period in New York city, the guest of relatives. Captain W. L. Candee, manager of the Okonite Company, entertained Mr. James at luncheon at the Hardware Club on Monday of last week, at which were present a number of Mr. James's New York electrical friends.

MR. E. B. DOEN, superintendent of the Syracuse (N. Y.) Lighting Company, has resigned this position to enter the electrical contracting business. Mr. Doen has been connected with the Syracuse Lighting Company for over twenty-one years. His successor as superintendent is M. G. Kennedy, formerly assistant inspector.

MR. E. E. KELLER, for over twenty years connected with the Westinghouse interests and for fourteen years vice-president of the Westinghouse Machine Company, having completed his duties as receiver and general manager, severed his connection with the management of that company on the first of this month. Mr. Keller will take a much-needed rest and will then devote most of his time to several personal interests.

MR. STARBUCK SPRAGUE has resigned as New England manager for the Helios Manufacturing Company to accept the position of general sales agent for the American Flaming Arc Lamp Company, Boston, Mass. Mr. Sprague has been active in the introduction of arc lamps and after a very careful study of the new type of "American" flaming lamp, he will undertake its introduction.

MR. SAMUEL ANDERSON has succeeded Horatio Bigelow as superintendent of the Connecticut Company's lines in eastern Connecticut, extending from New London on the south to the state line on the north, and comprising about 105 miles of road. Mr. Anderson began his railroad career in 1872, and has been connected with the New Haven system since 1884. His headquarters will be at Norwich, Ct.

MR. H. F. GRANT, for many years manager of the Seattle (Wash.) Electric Company, and district manager of the Stone & Webster interests in the Pacific Northwest, has resigned. E. E. Potter has been named as acting manager. Mr. Grant will devote himself to the Stone & Webster interests in the Northwest as district manager. Former General Superintendent J. B. Lukes becomes superintendent of power of the Stone & Webster companies in the Pacific Northwest, and C. A. Hammond resigns as claim agent.

ELECTRICAL SECURITIES.

Security prices scored a very general increase last week, and while operations were largely professional, the indications are that these prices will be maintained for some time. The happy outcome of the Erie Railroad's financial difficulties, through the action of E. H. Harriman in making large purchases of new six per cent notes, in sufficient quantity to reduce the maturing obligations, kept this institution out of receivership and undoubtedly strengthened the industrial situation in every direction. While business improvement still continues, it is not accelerating at the same rate as has been the case for the last two months. This is quite natural, as this is the period when it is expected that there will be some falling off in business, even in the most prosperous times. The reshaping of political events and the indications that there is a decided reaction in the agitation for the wholesale regulation and control of large corporations are hopeful signs that, taken with the large accretions of wealth which are now available through banking and other financial institutions, render the likelihood of an early resumption of healthy business activity easily possible. Electric corporations particularly seem not to have been involved very heavily by recent events, as is evidenced by a perusal of their financial accounts.

Dividends have been declared by the following companies:

Binghamton (N. Y.) Light, Heat and Power Company; regular quarterly dividend of 1½ per cent on the preferred stock and the regular dividend of ¾ of 1 per cent on the common stock, payable April 15. American Light and Traction Company, New York; regular quarterly dividends of 1½ per cent on the preferred stock and 1½ per cent on the common stock, both payable May 1. United States Telephone Company; regular quarterly dividend of 1½ per cent on the preferred stock, payable May 15. Central District and Printing Telegraph Company; regular quarterly dividend of 2 per cent, payable April 30. East St. Louis & Suburban Company, regular quarterly dividend of 1¼ per cent on the preferred stock, payable May 1 to stock of record April 15. San Diego (Cal.) Consolidated Gas and Electric Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable April 15. Oklahoma Gas and Electric Company; quarterly dividend of 1¼ per cent on the preferred stock, payable April 15. Lincoln (Neb.) Traction Company; regular semi-annual dividend of 4 per cent on the common stock, payable April 15. Electric Bond and Share Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable May 1. United Electric Securities Company; regular semi-annual dividend of $3.50 on the preferred shares, payable May. 1.

ELECTRICAL SECURITIES FOR THE WEEK ENDED APRIL 11.

New York:	*Closing.*
Allis-Chalmers common	7⅞
Allis-Chalmers preferred	20⅛
Brooklyn Rapid Transit	47⅛
Consolidated Gas	120
General Electric	132
Interborough-Metropolitan common	9¾
Interborough-Metropolitan preferred	26½
Kings County Electric (ex interest)	104
Mackay Companies (Postal Telegraph and Cables) common	60
Mackay Companies (Postal Telegraph and Cables) preferred	64½
Manhattan Elevated	124
Metropolitan Street Railway	33½
New York & New Jersey Telephone	102
Western Union	53
Westinghouse Manufacturing Company	55½

The business of the Westinghouse Electric and Manufacturing Company in the month of March was regarded as satisfactory considering the general state of trade, shipments billed amounting to $1,800,000. It is not believed, however, that the report for the current month will be as favorable. The Westinghouse company is operating about fifty per cent of its capacity.

Boston:	*Closing.*
American Telephone and Telegraph	113¼
Edison Electric Illuminating	209½
Massachusetts Electric	45
New England Telephone	111
Western Telephone and Telegraph preferred	66

Philadelphia:	*Closing.*
Electric Company of America	9
Electric Storage Battery common	27½
Electric Storage Battery preferred	27½
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	17⅜
United Gas Improvement	79½

Chicago:	*Closing.*
Chicago Telephone	—
Commonwealth Edison	91½
Metropolitan Elevated preferred	47½
National Carbon common	57
National Carbon preferred	110

ELECTRIC LIGHTING.

GENESEO, ILL.—The electric light plant was destroyed by fire on April 2. No insurance was carried.

MEMPHIS, TENN.—The power-house of the Brownsville Light and Power Company was destroyed by fire on April 4.

MOUNT AYR, IOWA—At the city election a twenty-five-year franchise was granted to the Mount Ayr Light and Power Company.

PINE BLUFF, ARK.—Contracts have been let by the Pine Bluff Light and Water Company for the erection of a new power plant and reservoir.

GLENS FALLS, N. Y.—The Kanes Falls Pulp Company has under way the transformation of its pulp mill at Fort Ann into an electric generating plant.

POSEYVILLE, IND.—The town board has granted a twenty-five year franchise to Frank Seib and others to install an electric light plant. Work will be begun at once.

CORPUS CHRISTI, TEX.—At a meeting of the city council a franchise for a second electric light plant for Corpus Christi was granted to Clark Pease and associates.

TORONTO, ONTARIO—The city council has decided in favor of an application to the Hydroelectric Power Commission for electrical energy to the extent of 10,000 horse-power.

GREENVILLE, S. C.—Announcement is made that the Southern Power Company will run its lines into this city, having power ready for delivery here early in September.

MONTPELIER, VT.—John Parrott, of Bethel, and B. A. Durkee, of Randolph, have signed a contract to install an electric plant in Gaysville. They expect to begin work soon.

RICHFORD, VT.—The voters of the village of Sutton, Quebec, have accepted the proposition made by the Sweat-Comings Company of this village to furnish electricity for lighting the villages of Sutton and Abercorn, Quebec.

NAPOLEONVILLE, LA.—The five-mill special electric light tax which was voted on by the property holders of this town resulted in victory for the tax. This insures municipal ownership of the plant, as the amount realized from the tax will enable the meeting of outstanding obligations.

ROANOKE, VA.—The common council has unanimously voted to award the contract for lighting the city for five years to the Roanoke Water Power Company. The city is now lighted by the Roanoke Railway and Electric Company at $70 per annum while the power company contract is $49 per annum.

TACOMA, WASH.—F. G. Simpson, an electrical engineer of Seattle, has completed an investigation of the city's lighting plant and its methods of operation, and recommends that the city at once appoint a commission of engineers to locate and make plans for a city lighting plant of not less than 10,000 horse-power.

THERMOPOLIS, WYO.—A thirty-day option on the plant of the Hot Springs Electric Light and Power Company has been taken by E. J. Thompson, of Billings, Mont., who paid $1,000 for the agreement, and binds himself to pay $30,000 for the plant. The Hot Springs company's power is derived from the hot springs belonging to the state.

SPRAGUE, WASH.—Eugene Enloe, head of the Big Bend Light Company, part of the Washington Water Power Company, of Spokane, has closed a deal with the Sprague Light Company to take over the latter's plant. Active work has been started on putting in the pole line. The men will work northwest from Sprague to the connecting line from Harrington to Ritzville.

MINNEAPOLIS, MINN.—It is announced that the Minneapolis General Electric Company is to be given a franchise by the Minneapolis city council. The franchise will be for thirty years, but the city retains the right to purchase the plant at the end of any five-year period. The city also retains the right of inspection and regulates the prices that are to be charged, a schedule having been adopted.

COOPERSTOWN, N. Y.—The Public Service Commission, Second District, has granted the petition of the Great Bear Light and Power Company for permission to construct its plant and exercise franchises within the villages of East Worcester, West Richmondville and Richmondville, Schoharie County, and for permission to issue $20,000 capital stock, a first mortgage for $20,000, and $20,000 in bonds to be secured by said mortgage.

NEWPORT, ARK.—According to the contract of the city of Newport with the Newport Gas Company, the city is to pay the company $90 per annum for each arc light, or $7.50 per month, a reduction of more than $2.50 per light in the rate now paid the old company. The new company is to install electric light service by October 15, and must give a $10,000-bond subject to the approval of the city attorney and the city council.

PASADENA, CAL.—Superintendent Koiner, of the municipal electric light plant, has submitted his report to the council. In it he sustains the suggestions made in the Cory-Scattergood report. Mr. Koiner recommends that many arc lights be removed where their efficiency is impaired by heavy foliage, and that they be replaced by incandescent lights. He makes recommendations that will call for an expenditure of about $18,000.

PRINCETON, N. J.—The trustees of the Princeton Theological Seminary, at a recent meeting, voted $72,000 for a new electric lighting and heating plant. The contracts have been awarded and the work will start at once under a guarantee to have the plant ready for use by September 1. W. R. Matthews, of Princeton, has been given the contract for the building. J. H. Lehman & Company have the electrical work in hand, while the Ridgway Dynamo and Engine Company will install the machinery.

ST. LOUIS, MO.—The Transmississippi Electric Company, through its attorney, T. L. Swarts, has applied to the board of public improvements for permission to lay conduits and erect poles and string electric light and power wires in the district bounded by Euclid avenue, King's Highway, Lindell and Forest Park boulevards. The company believes it may do this under the Keyes ordinance of 1894, which gave companies the right to put in electric plants upon acceptance of and compliance with certain conditions imposed by the city.

INDUSTRIAL ITEMS.

THE SIRCH ELECTRICAL AND TESTING LABORATORIES, Los Angeles, Cal., will be pleased to send descriptive data devoted to the Sirch rectifier for power duty, for general purposes, and for charging ignition batteries. This rectifier is of the electrolytic type, is compact, and is stated to be extremely durable.

DOSSERT & COMPANY, 242 West Forty-first street, New York city, have received an order from L. K. Comstock & Company for solderless connectors and terminals for use in the Silversmiths' Building, Maiden Lane, New York city. The same company has also ordered a large number of Dossert lugs of 1,500,000 circular mils size for the generators and generator panels in the City Investing Building.

THE AURORA ELECTRIC COMPANY, Aurora, Ind., has ready for distribution some attractive literature describing its electromagnetic socket for direct current. This is a self-supporting device, which, by means of magnetic attraction to iron or steel, will hold and support an incandescent lamp in any position, allowing the light to be applied directly where desired. The company is also making a new form of arc lamp.

THE GENERAL STORAGE BATTERY COMPANY, Boonton, N. J., has issued bulletin No. 9, devoted to "Permanized" negative plates. This process eliminates the shrinkage which takes place in new negative plates, reducing the capacity as the plates progress in service. The plates treated by this process are unique, not only in that they sustain their capacity, but are possessed of other mechanical and electrical advantages.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued bulletin No. 4,573, devoted to a description of graded shunt resistance multi-gap lightning arresters. The bulletin also contains detailed descriptions of low-voltage arresters, static dischargers, constant-current horn arresters, disconnecting switches, choke-coils, and the well-known type M form D-2 direct-current arrester for

voltages up to 6,000. Tables of general data regarding the apparatus, connection and dimension diagrams, etc., are included. The company has also issued bulletin No. 4,570, devoted to G. E. tungsten lamps for standard lighting service.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has issued a series of interesting bulletins which will be supplied to those interested upon request. Bulletin No. 95 is devoted to belt-type, alternating-current generators, and No. 97 to direct-current switchboard panels. No. 98 describes form L machines, belt type, direct current—motors, one-twentieth to five horse-power; generators, 0.6 to 2.5 kilowatts. No. 99 describes Crocker-Wheeler motors in the Bethlehem rail and structural mills, and No. 100 form I machines, belt type, direct current—motors, five to forty-five horse-power; generators, four and one-half to forty kilowatts.

THE AMERICAN FLAMING ARC LAMP COMPANY, Boston, Mass., is now installed in its new factory and offices, 138-148 Purchase street, Boston, Mass. This company has just been incorporated under the laws of Massachusetts with a capital of $150,000, for the introduction of the new American flaming arc lamp. The officers of the company are: President, Charles H. Sprague; vice-president, Charles D. Lanning; treasurer and general manager, Joshua D. Robinson; secretary, J. Gardiner Bartlett. Directors: Charles H. Sprague, Charles D. Lanning, James K. Lanning, Walter G. Morey, Joshua D. Robinson, Dana P. Bartlett, Malcolm H. Baker.

Record of Electrical Patents.

Week of April 7.

883,701. SWITCHING DEVICE. James A. Duffy and Oscar Irwin, Pittsburg, Pa., assignors of six-tenths to Charles D. Armstrong, Pittsburg, Pa. The trolley wire has insulated sections, one section containing electrical connections for actuating the switch-shifting mechanism, and the other section having electric connections controlling the action of the first section.

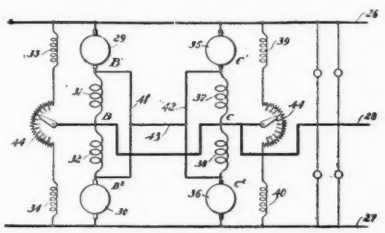
883,723. ELECTRIC TRANSMISSION OF INTELLIGENCE. Isidor Kitsee, Philadelphia, Pa. Method of neutralizing inductance from neighboring wires.

883,724. ELECTRIC TRANSMISSION OF INTELLIGENCE. Isidor Kitsee, Philadelphia, Pa. The rails form part of an inductive return of the power wire.

883,760. SYSTEM OF DISTRIBUTION. Lewis L. Tatum, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. The shunt field-windings of the dynamo in a multiple-voltage system of distribution are connected across the main conductors in series; a rheostat arm is connected to a compensating conductor.

883,777. CLUSTER-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. An adjustable combination wireless cluster.

883,811. TELEPHONE SUPPORT. Otto Kraus, New York, N. Y. The shank is fitted with a ball-and-socket joint.



883,760.—SYSTEM OF DISTRIBUTION.

883,822. DYNAMOELECTRIC MACHINERY. Charles A. Parsons, Newcastle-upon-Tyne, England. Ventilation is provided by metal strips placed around the conductors forming a path from the interior of the body to the outer extremities.

883,823. INSULATOR SUPPORT. Charles L. Peirce, Jr., Elkhart, Ind., assignor to Peirce Specialty Company, Chicago, Ill. A coil spring surrounds the supporting member.

883,846. ELECTRICAL MULTIPLE INFLUENCE OR CONDENSER MACHINE. Heinrich Wommelsdorf, Charlottenburg, Germany. Two systems of discs revolve in opposite directions.

883,919. REACTIVE COIL. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. A reactive coil is combined with a vapor-electric device and means for maintaining the inductive discharge of the reactive coil.

883,924. ARC-LAMP ELECTRODE. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. An electrode consisting of titanium carbide encased in a copper sheath.

883,943. REVERSE-CURRENT CIRCUIT-BREAKER. Charles E. Eveleth, Schenectady, N. Y., assignor to General Electric Company. A polarized core located in the magnetic field operates by closing the circuit through a shunt coil.

883,944. ELECTRIC LIGHTING. Walter C. Fish, Lynn, Mass., assignor to General Electric Company. The light from a vapor-electric lamp is reflected to a light-transmitting reflector, behind which is placed an electric lamp having a different color value.

883,956. MOTOR STARTER. Albert J. Horton, White Plains, N. Y., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The lever-arm may be moved to a predetermined position and held there by independent means.

883,961. ELECTROMETALLURGICAL PROCESS FOR EXTRACTING COPPER FROM ITS ORES. Lucien Jumau, Paris, France. The ores are lixiviated in an ammoniacal solution and the cuprous sulphite is subjected to electrolytic action in the presence of carbonate of ammonia.

883,964. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS. Harry N. Latey, New York, N. Y. The relay between the conductor sections and the signal system is dependent for operation upon a predetermined difference of potential between the sections controlled by the relay.

883,992. ELECTRIC TIME-INDICATING DEVICE. William F. Wentz, New York, N. Y. A step-by-step ratchet and means for closing an electrical contact through the pointers on a dial face.

884,002. CONTROLLER FOR ELECTRIC MOTORS. Thomas E. Barnum and Henry H. Cutler, Milwaukee, Wis., assignors to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The resistance is automatically removed from the circuit and manually inserted in the circuit.

884,007. TRAIN CONTROL FOR ELECTRIC ACCUMULATOR-LOCOMOTIVES. Otto Böhm, Berlin, Germany. While all motors and batteries are connected in series and controlled from the master controller, the individual controlling elements are permanently fixed at full speed.

884,015. ELECTROLYTIC CELL. Albert S. Gray, Chicago, Ill., assignor to Ross J. Beatty, trustee, Chicago, Ill. The entrance and outlet form opposite electrodes, and the cell is equipped with multiple vents for the escape of evolved gases.

884,018. INCUBATOR ALARM. Fremont R. Harris, Kenmare, N. D. The movable damper arm closes an electric circuit to a bell.

884,028. ACCUMULATOR PLATE. Michail Margulis, Odessa, Russia. The active material is placed in a receptacle composed of interleaved strips of straight and wavy metal.

884,047. AUTOMATIC-ALARM SYSTEM. John E. Shepherd, Chicago, Ill. The action of the diaphragm closes an electric circuit.

884,049. PNEUMATIC HOLDER FOR COMMUTATOR BRUSHES. Charles W. Speirs, Battersea, London, England, assignor to Morgan Crucible Company, Limited, London, England. The tension is furnished by a flexible and extensible chamber supplied under pressure by an outside means.

884,070. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass., assignor to Stone Telegraph and Telephone Company, Boston, Mass. The system has a normally open intermediate circuit connecting a sonorous circuit to the secondary of the transformer, in the primary of which is a normally closed power circuit.

884,071. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass., assignor to Stone Telegraph and Telephone Company, Boston, Mass. The periphery of the elevated conductor system is large compared with its distance above the earth.

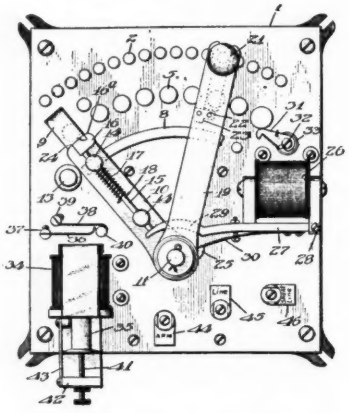
884,074. ATTACHMENT FOR TROLLEY-POLE CLAMPS. Curtis W. Clark and Charles E. Yingling, Eaton, Ind. A set of clamping plates operated by a lever for attaching the trolley pole to the supporting member.

884,075. ELECTRODEPOSITION OF IRON. Sherard O. Cowper-Coles, London, England. An electrolyte is formed and maintained from a substance containing iron.

884,076. SPACE TELEGRAPHY. Ernest R. Cram, Cambridge, Mass., assignor to Stone Telegraph and Telephone Company, Boston, Mass. A circuit is interposed between the elevated-conductor system and the resonant receiving circuit, attuned to the frequency of the waves to be received, the interpolated circuit having a pronounced natural rate different from that of the resonant receiving circuit.

884,102. ELECTRIC-LAMP SOCKET. Mortimer Norden, New York, N. Y., assignor to Joseph Norden, New York. A socket equipped with locking screws.

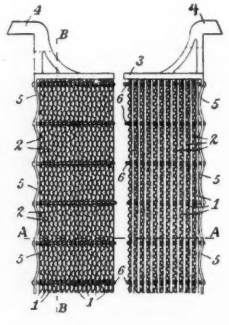
884,106. SPACE TELEGRAPHY. John S. Stone, Cambridge, Mass., assignor to William W. Swan, trustee, Brookline, Mass. The system includes a parallel branch circuit in the conductor system and a resonant receiving circuit adapted to balance a persistent train of electrical oscillations.



883,956.—Motor-Starter.

884,107. SPACE TELEGRAPHY. John S. Stone, Cambridge, Mass., assignor to William W. Swan, trustee, Brookline, Mass. An elevated conductor in the system and the receiving circuit are connected in parallel to earth.

884,108. SPACE TELEGRAPHY. John S. Stone, Cambridge, Mass., assignor to William W. Swan, trustee, Brookline, Mass. Parallel branch circuits having capacity in one branch and inductance in the other are connected in parallel to the earth with the elevated conductor.



884,028.—Accumulator Plate.

884,109. SPACE TELEGRAPHY. John S. Stone, Cambridge, Mass., assignor to William W. Swan, trustee, Brookline, Mass. The branch circuit has a zero reactance for the same frequency for which the reactance of the elevated conductor is zero.

884,110. SPACE TELEGRAPHY. John S. Stone, Boston, and Sewall Cabot, Brookline, Mass., assignors, by direct and mesne assignments, to William W. Swan, trustee, Brookline, Mass. A thermoelectric detecting device.

884,116. ELECTRICAL-IGNITION SPARK-COIL FOR GAS OR VAPOR ENGINES. Edward Q. Williams, Syracuse, N. Y., assignor to the Connecticut Telephone and Electric Company, Incorporated, Meriden, Ct. Each of the separate insertible elements is equipped with a suitable vibrator.

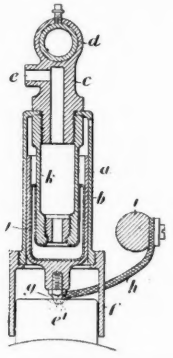
884,121. AUTOMATIC ELECTRIC ALARM FOR BEDS TO BE OCCUPIED BY PATIENTS, SUCH AS HOSPITAL BEDS. Frank Apold, Philadelphia, Pa. Undue vibrations close an electric circuit to a bell.

884,124. PROCESS FOR THE ELECTROLYSIS OF FLUID SALTS OR COMPOUNDS. Henry S. Blackmore, Mount Vernon, N. Y. The two fluid bodies are separated by a fluid of greater density, which acts as a fluid membrane or diaphragm.

884,129. ELECTRIC SIGNAL. Arthur J. Cleveland and Frank S. Brown, Minneapolis, Kan. Contact with the rail is made by means of a lever arm and shoe.

884,130. ELECTRIC TIME-SWITCH. James J. Coachman, London, England. The time element is provided by a fluid element supporting a weighted body which closes an electrical circuit.

884,158. SYSTEM OF AUTOMATIC BLOCK SIGNALING FOR ELECTRIC RAILWAYS. Winthrop K. Howe, Buffalo, N. Y., assignor to General Railway Signal Company. An automatic alternating-current signaling system controlling a track circuit equipped with means for supplying direct current to the local blocks.

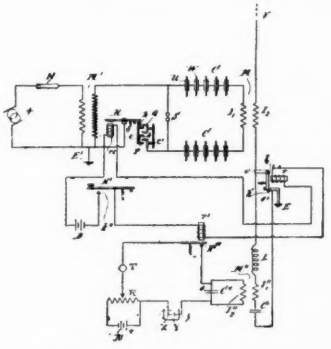


884,049.—Pneumatic Holder for Commutator Brushes.

884,170. THIRD-RAIL ELECTRIC-RAILWAY SYSTEM. Charles Kozesnik, New York, N. Y. An intermittent-contact third-rail conductor.

884,224. RAILWAY-SIGNAL. John S. Sims, Longbeach, Cal., assignor of one-half to Edward Richard Millar, Longbeach, Cal. The signal member is moved against the action of gravity when the magnet is energized.

884,235. RECEIVER FOR TELEPHONES. Louis Steinberger, New York, N. Y. The magnet system and diaphragm are entirely enclosed in a protective chamber.



884,070.—Space Telegraphy.

884,264. STORAGE BATTERY. Georgie A. Carpenter, New York, N. Y., administratrix of Hiram Henry Carpenter, deceased, assignor, by mesne assignments, to American Battery Company, Cedarhurst, N. Y. A plurality of positive plates sandwiched between negative plates, one positive plate having a surface substantially equal to that of one pair of negative plates, and connections for joining together the positive poles.

884,271. ELECTRIC-LIGHT SOCKET. Franz Frankofski, North Braddock, Pa. An insulating cap.

884,312. ELECTRICAL CONNECTOR. James L. Carnall, New York, N. Y. An insulated two-way connector.

884,343. ELECTRIC WATER HEATER. Herbert N. Roche, San Francisco, Cal., assignor of one-half to Thomas B. Gray, San Francisco, Cal. One of the contacts provides a frictional resistance against the removal of a supporting rod.

884,345. CONTROLLER. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. The pole-pieces of the blowout magnets form the bearings for the controller shaft.